SCIENCE

AN ILLUSTRATED JOURNAL

PUBLISHED WEEKLY

VOLUME VII

JANUARY—JUNE 1886

NEW YORK
THE SCIENCE COMPANY
1886

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SCIENCE.

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Vérité sans peur.

NEW YORK: THE SCIENCE COMPANY.

FRIDAY, JANUARY 1, 1886.

COMMENT AND CRITICISM.

TO MANY PEOPLE in this practical era, the manifest usefulness of work done affords the only available standard of judging every thing. It is worth the while to see how the coast survey abides this test; for it can point to its system of charts covering every harbor of prominence in the country, and nearly all the shore-line between them, all the principal rivers to the head of tidal influence, and Lake Champlain; to its researches and publications relating to terrestrial magnetism, and its magnetic charts; to the tide-tables, published annually, of the ports on the Atlantic, Gulf, and Pacific coasts; to the 'Coast pilots' for the Atlantic and Pacific coasts and Alaska; to its explorations and discoveries in physical hydrography; to its transit-of-Venus and eclipse expeditions, and longitude determinations in Alaska and in foreign countries; to its work on the Isthmus of Panama; to the numerous scientific publications on all subjects relating to or connected with its work; to the determinations of the force of gravity in all parts of the world; to very considerable improvements in geodetic and field-astronomical instruments; and to the present perfected system of weights and measures, which has secured harmony not only within the United States by supplying standard weights and measures to every state, to the principal custom-houses, and to the agricultural colleges in the several states, but also between our own country and foreign nations.

Such an amount of scientific and practical work of the highest merit could not possibly have been accomplished except under the wisest organization and the most efficient supervision. The character of this work is itself the sufficient argument for the maintenance of that organization. With so exceptional a record of work actually accomplished, embracing so much that is of immediate economic bearing upon the welfare of the country and the conservation of national interests, the survey need have little fear of hostile criticism, and, least of all, that having its origin in personal or political motive. The obviously useful character of a large part of this work shows that it is of real and direct value to the nation, apart from its purely scientific merit.

THERE IS NO PORTION of North America where complete and long-continued series of tidal observations are more important, and will yield more interesting results, than the coast of Canada. The great rise and fall in some portions, and the anomalous conditions and irregular and unequal tidal currents prevailing along its deeply indented shores, render a careful study of them a matter of serious interest from both a scientific and practical point of view. We are glad to see that the matter has been attracting attention among our neighbors, and that the different commercial bodies of Canada have moved in the matter. A report on the subject by a committee of the British association, at the Aberdeen meeting, shows what has been done, and what is proposed. The matter is one more of general than local importance. As such, it appears to be well worthy the attention of the imperial government, which, at small cost to itself, can here properly come to the aid of the colonial department of marine, in the interest of the commerce and navigation of the world. Tidal observations on the eastern coast of America have gained a new importance since the coast and geodetic survey has confirmed by recent observations its announcement, some years since, that there are tidal fluxes in the Gulf Stream, and variations of its velocity due to half-monthly changes in the relative sea-levels of the Atlantic and Gulf of Mexico.

JUDGED BY THE RESULT, it would seem that the civil engineers' convention, recently held at Cleveland, to consider the relations of civil and military engineers, found, that, like an historical gathering at Ephesus, it had come together with-

out sufficient reason. Congress is asked by the convention to 'organize a civil bureau of public works' in a certain way, and for certain reasons. It is difficult for an onlooker to interpret the way and reasons, otherwise than that the army engineers are in possession of a good thing which some of their civil brethren covet: hence the intervention of congress is invoked to change the established order, to put the one class out and the other in, or, if this may not be, that the good thing be at least divided. The reasons given are weak, and open to dispute, some easily refuted: and the request that the basis of organization of the proposed bureau should be studied and reported on by a board consisting of seven members — three military engineers, three civil engineers, and a lawyer — savors quite strongly of place-making for some of the leaders in the movement. All this is unfortunate. There are strong and good reasons why the organization for the conduct of public works should be recast, just as necessity for reorganization has been found in other departments of administration. That these reasons exist is proven by the fact that a letter from the chief of engineers, U. S. army, General Newton, was read at the meeting, expressing sympathy with any move which would better the public service. The betterment of the public service ought to have impressed itself upon the Cleveland meeting as being the only ground upon which they could go before the country with reasonable expectation of being listened to. Instead of this, the convention considered the question as one of class, and seeks to secure class legislation in a way which is itself a suggestion that congress is incapable of doing its own work.

THE COAST AND GEODETIC SURVEY.

THE time was long ago when any one would think of asking what is the use of having any coast survey at all, — one might almost say, long past, when any one would expect that the work of such an organization could ever be brought to an end. As originally constituted, by the act of 1848, the organization was empowered to proceed with the accurate mapping of the Atlantic and Pacific coasts of the United States, — a work which involved a trigonometric survey of the coast lands to be conducted with the utmost precision. This formed also the only suitable basis for the hydrography of the coasts.

Those interested in the thorough prosecution of this work were not slow to enquire into the obvious advantages of connecting the independent surveys of these coasts into a single homogeneous system. The surveys of individual states might thus be supplied with the precise determination of points for their own topographic and geologic work, and the entire domain of the United States be covered by a net-work of triangles of the utmost accuracy. The foundations of this vast work were laid nearly fifteen years ago; and in its execution natural precedence has been given to those regions where there was the most urgent call for the work. Such a connecting-link is a necessary part of a survey of the 'coasts and adjacent islands, etc., of the United States,' as originally provided for by law, in order to bring into harmony the measurements along the Atlantic and Pacific coasts. As Professor Hilgard has pointed out, this is sufficiently obvious to allow the belief that it would have been specified in the original law, if, at the time of its enactment (1807), the country had had a 'western coast.'

But this is not all: what is the obvious requirement of the law has led, in addition, not only to the incidental accomplishment of important scientific results, but also to many advantages of the most practical significance. To appreciate the former, we need only recall that our national domain extends in an east and west line over about one-eighth of the circumference of the entire earth, and that the accurate measurement of this line, as undertaken by the survey, will constitute much the longest arc-parallel ever measured for determining the size and figure of the earth. The same survey will afford accurate elevations of a multitude of points above a common datum plane, and will show the relation of the mean level of the Atlantic and Pacific oceans. From a purely scientific stand-point, these would be reasons enough for completing the transcontinental survey as originally outlined; but let us see what some of the practical advantages of the work are. To begin with, this already well-advanced scheme of a national survey, from ocean to ocean, provides every subsidiary state survey with an accurate base-line. How important this is will appear if one attempts to conjoin the hitherto existing surveys of adjacent states. Discrepancies of many miles are frequent; for example, "The best maps of the states of Ohio, Indiana, and Kentucky, constructed upon independent data, when put together, leave no delineation of the Ohio River. Between the land-survey maps of Illinois and Missouri, the Mississippi River presents in places wide lakes, while in others it entirely disappears." The transcontinental link also adjusts the lines and points of the public land surveys, and furnishes the necessary data

for the compilation of town, county, and state maps of the utmost precision. Nor is the fact lost sight of that in time it will become necessary to have an absolutely correct map of the entire area of the United States. Work of this character has been for years in progress, and in its continuance rests the only possibility of bringing harmony into what is now utter confusion.

All who have taken even the least cognizance of the scientific methods systematically pursued by the coast survey will experience no difficulty in seeing that the uninterrupted exertions of scores of trained observers and calculators are demanded in completing the thorough survey of so extended a field as that of the Atlantic and Gulf coast. Very few outside of those actually engaged in such work take occasion to know the degree of precision sought and attained in these investigations; nor is it a matter of common information that the work has so far advanced that the survey of the Atlantic and Gulf coast is about nine-tenths completed. The slightest knowledge of the necessary conditions is sufficient to show that, even when the entire extent of the coast has once been charted, a large amount of work must continually be done, in order to maintain the correctness of the charts, and 'Coast pilots' or sailing-directions. Professor Hilgard estimates, that, in order to keep up this work, a force of two parties will be required — one ashore and one afloat — in each of five districts between Passamaquoddy Bay and the Rio Grande.

The entrance of the important harbor of New York is kept under annual examination, in order to keep track of the changes, and to control, if possible, their causes. A complete re-survey of the great thoroughfare of Long Island Sound is in progress, as in time great changes have taken place, and many localities have very much grown in importance. Also thorough re-surveys are progressing in other waters as rapidly as the limited appropriations for this work will allow.

The survey of the Pacific coast, between San Diego (the Mexican boundary) and Fuca Straits, with Puget Sound, is about three-fifths completed; and the publication of charts, sailing-directions, and tide-tables is proportionally advanced. The same considerations in regard to future re-surveys hold here equally with the Atlantic coast: one re-survey of San Francisco Bay was made about twelve years ago, and a new one is now strongly urged. In the territory of Alaska, no minute or exact surveys have yet been undertaken, as the condition of the country does not yet call for them; but a good deal has been done in the way of geographical exploration and hydrographic reconnaissance; while many charts of approximate correctness have been published, as well as a volume of sailing-directions. Mention must be made, in this connection, of the explorations of the Gulf Stream, having for their object the discovery of the laws which govern it, with the view of taking due account of it in navigation as an indication of the approach to our shores; as also of the practical researches into the distribution and laws of change of the earth's magnetism, by which we have been enabled to ascertain the variation of the compass along the coasts, as well as over the whole country, — a knowledge equally important to the mariner and to the land-surveyor.

In no department of its coast operations is the practical usefulness of the survey more apparent than in its systematic researches and publications relating to the safety of navigation. Foremost among these are the thorough series of observations of the tides. In addition to this, advantage is taken in the most practical way of all discoveries and developments affecting the safety of navigation by the printing and wide circulation of the series of 'notices to mariners.' During the year 1883–84, for example, twelve such notices were published as warnings to navigators against newly discovered or newly developed dangers. Also the studies of officers of the survey in the department of physical hydrography have led to results of the highest practical importance in our commerce and navigation.

In his late message to congress, the President of the United States alludes once more to the threadbare subject of transfer of the coast and geodetic survey to the navy department. Three years ago the superintendent of the survey, in a letter to the secretary of the treasury, reviewed the whole ground in the most thorough and impartial manner, concluding with the following points in opposition to this proposed transfer. They may be advantageously cited here: —

"1°. The present system, perfected nearly forty years ago, has proved thoroughly efficient, economical, and satisfactory to the country. It is wise to hold fast to that which has been proved to be good.

"2°. It affords to the navy all the advantages that can legitimately be claimed. It employs as many of its officers in service afloat as can be advantageously used in hydrography. The employment of a larger number, in the event of a transfer, would result in training naval officers to be geodesists, topographers, chiefs of technical bureaus, and in withdrawing their interests and habits from the naval service proper.

"3°. The efficiency of the service would suffer by the loss of ambition and emulation, which exist at present in a high degree, but which find no stimu-

lus in a service where no positions of responsibility and direction are open to civil experts, however great their attainments and devotion to the public service."

Some months subsequently, in a letter to the committee of the National academy of sciences, the superintendent added the important considerations that the naval officers detailed by their department for coast-survey duty are almost without exception well pleased with their service in this capacity, although, in reality, more arduous than the regular routine of the naval service in time of peace. They are at all times, however, perfectly under the control of the navy department, and subject to being detached and ordered upon other duty. No officer of the navy above the rank of commander is attached to the survey, and most of the officers are of the grades between ensign and lieutenant. In this survey work they obtain a most valuable experience, which stands them in great stead on foreign stations.

The alleged duplication of work by the coast survey and the hydrographic office of the navy department is often urged as a reason for the transfer of the survey to the navy; but in reality there is no clashing. The special work of the hydrographic office consists in publishing charts of foreign coasts for the use of the navy and our commercial marine, as also of directing surveys on foreign coasts by our naval vessels when their opportunities permit. The functions of the two offices are thus entirely different.

The hydrographic work conducted by the coast survey along our own shores is not a nautical survey, but, properly speaking, a trigonometrical survey, in which the positions of the depths observed, and of rocks and shoals, are determined by the observation of angles upon objects on shore, which are known by the triangulation and topography. The hydrography is closely co-ordinated with these, and cannot be separated from them without losing much of its present excellence.

DAVID P. TODD.

RECENT CHANGES IN CORNELL UNIVERSITY.

THE growth and prosperity of Cornell university are shown in the measures which its trustees are taking to enlarge and strengthen its faculty. The value of a university lies in its teaching force. Cornell university has been put by its benefactors on a firm financial basis, and the trustees are wisely preparing to employ its increased revenue in adding to its facilities for instruction. The most important of these new measures is the re-organization of the Sibley college of mechanical engineering, with Dr. R. H. Thurston as its director. Following this are the measures just consummated and announced, providing for other changes in the faculty. Dr. Wilson, the distinguished and venerable professor of moral and intellectual philosophy, and Professor Schackford, the professor of rhetoric and general literature, are retired at the end of the present year with liberal allowances. A professorship of pedagogy has been established; and Prof. S. G. Williams, now occupying the chair of geology, is appointed to the new professorship. As this is a new feature in our New York colleges, the results of the experiment are looked to with great interest. Professor Williams has had an unusual training for such a professorship. As a teacher in preparatory schools, as a superintendent of schools, and a professor in Cornell university, he has enjoyed an experience which will enable him to put himself in sympathy with those who are preparing themselves for teaching, and to give them whatever aid is possible.

The retirement of Professor Williams from the chair of geology enables the trustees to consolidate the now separate departments of geology and paleontology in one, and to promote Prof. H. S. Williams, who has occupied the latter chair, to the professorship of geology and paleontology. Other changes are either made or contemplated which will still further re-enforce the board of instruction. Not the least important of these changes is the increase in the salaries paid to all the principal porfessors. The inadequate compensation heretofore allowed has cost the university in several instances the loss of men whom it would have been glad to retain. Two of the professors are to receive \$3,200 each; eleven others, \$3,000 each; and in other cases the stipends have been proportionately increased.

S.

THE ABBOTT COLLECTION AT THE PEABODY MUSEUM.

THE collection of stone implements made at Trenton, N.J., by Dr. C. C. Abbott, now on exhibition in one of the recently opened rooms of the Peabody museum of archeology at Cambridge, is one of the most important series of the kind ever brought together, and one which archeologists will consult for all time to come. It contains more than twenty thousand stone implements and several hundred associated objects, made of bone, clay, and copper, with several pipes and numerous ornaments and carved stones.

There are several considerations which give the collection exceptional importance. First, it was brought together from a very limited area by a single archeologist; all the specimens having been found by Dr. Abbott upon his own farm and its

immediate vicinity, with the exception of some of the paleolithic implements, and even these were found within an extreme radius of four miles. Second, the gatherings in this limited region have been so long continued and so thorough, that the result is a collection which shows *en masse* the work of the peoples who inhabited the Delaware valley at different periods, in a manner and to an extent never before obtained from any part of this country, and probably not from any other part of the world. Third, the collection is the same which formed the basis of Dr. Abbott's volume on 'Primitive industry,' and has been arranged by Dr. Abbott himself, under the direct supervision of the curator.

As now arranged, the Abbott collection exhibits at one and the same time the sequence of peoples in the valley of the Delaware, from paleolithic man through the intermediate period, to the recent Indians, and the numerical proportion of the many forms of their implements, each in its time. It thus forms an exhibition at once instructive to the general visitor, and of great importance to the serious student. It is indeed doubtful whether any similar collection exists, where a student can gather so much information at sight, as here, where the natural pebbles from the gravel begin the series, and the beautifully chipped points of chert, jasper, and quartz, terminate it in one direction, and the polished celts and grooved stone axes in the other.

The paleolithic implements from the gravel and from the talus include nearly all found, some of them coming from a depth of thirty feet in the gravel; with one exception, a black flint, they are made of a hard, fine-grained argillite; many are but slightly chipped, while others are of well-defined forms, similar to the paleoliths of the old world. With these specimens are the human skull, under jaw, and wisdom-tooth, found at different times in the same gravel as the implements.

Following the paleoliths are the several thousand rude and greatly weathered points and flakes of argillite of various forms. The relative importance of the different sorts to the people who used them is shown in an instructive way by grouping and heaping, so that the eye at once takes cognizance of this, while it detects at the same time the individuality of the makers. These points belong to the middle period of occupation of the valley; never found in the gravel, they are, as a whole, much older than the mere surface specimens and those from graves.

To these latter, the work of the recent Delaware Indians, belong the rude scrapers made by simply splitting a pebble, the rudely chipped agricultural implements of several kinds of stone, and the chipped scrapers, many of which are beautiful illustrations of this kind of work. These, like the arrow-heads, knives, and large spear-like implements shown in an adjoining case, are made from jasper of different colors, as well as from chert and quartz, and are shown in great variety and number. Of the other forms of implements, also illustrated by many varieties of each, are the hammer-stones, rubbing and polishing stones, pitted stones, mortars and pestles, celts and axes.

The ornamental stones are of various shapes, some of them simply perforated; the so-called gorgets are in various stages of manufacture, and there are several carvings representing human heads. A few pipes cut out of stone illustrate the Delaware type of tobacco pipe, while numerous fragments of pottery show that they were also made of clay. The potsherds exhibit a considerable variety of ornamentation, principally by incised lines, though many are cord-marked, and others have impressed designs. Two spear-heads of hammered native copper and a little group of miscellaneous objects are exhibited separately.

Another group of specimens, not included in the enumeration given above, though by no means an unimportant part of the exhibit, are the chips and refuse material of an Indian workshop. This large mass was sifted from the dirt in a single spot a few feet in diameter, evidently from where some Indian long worked in fashioning various implements. In the mass are thousands of chips of stones of various kinds, broken specimens, failures, hammer-stones, and nodules of jasper brought to the place, but still unwrought.

The collection and its arrangement are invaluable, unique, and of extreme importance to all who wish to study the stone age of our Atlantic coast. It reflects great credit upon the industry and sharp-sightedness of the collector, and exhibits as well the same perspicacity and serious method that is a marked feature of the entire museum. The problem of the exhibition of archeological objects, so that they may themselves give the most significant and instructive lessons, without reflecting transitory theories, has found an excellent solution at Cambridge.

FIRST LESSONS IN PHILOSOPHY.

PROFESSOR DE MORGAN, in his wonderfully witty 'Budget of paradoxes,' speaking of the dislike of most people to discriminate beyond a certain point, says, that, for the majority, "all such things as distinctions are evasions, subterfuges, come-offs, loop-holes, etc. They would hang a

First lessons in philosophy, being an introduction to metaphysic and logic for beginners. By M. S. HANDLEY. New York, *Scribner & Welford*, 1888. 16°.

man for horse-stealing under a statute for sheep-stealing, and would laugh at you if you quibbled about the distinction between a horse and a sheep." This certainly is most solemnly true, and is, among other things, the reason why people, as a rule, care so little for philosophy, the vital air of which is the persistent making of distinctions long after the saturation-point of the average human intellect has been reached. We all have our philosophies, to be sure, such as they are; but we all refuse to discuss them in the light of distinctions finer than our own. Such distinctions are 'cobwebs,' 'hair-splittings,' and the like; and we blankly ignore them with a perfectly good conscience. This is why no amount of criticism, however truly able, will shake the hold which certain popular philosophies have on 'the gallery;' for there is a gallery in philosophy, as in livelier spectacles. Mr. Shadworth Hodgson is certainly, of all English-writing philosophers, the one who makes the largest and most incessant demands on his reader's ability to take a distinction. He distinguishes after most of us long for rest, and he probably seems, in consequence, to the majority of those who open his pages, over-subtle and unreal, in spite of the extraordinary originality and vigor of every thing he writes. Many, to our knowledge, have wished that some disciple would come and issue his thoughts in the shape of small change, since they seem so little likely to become popular in the master's own massive statements. Miss Handley has essayed this useful task in the thin volume before us, which we recommend to all who would like a glimpse into some of the main features of Hodgson's system, but by no means to those to whom the title 'First lessons in philosophy' suggests a text-book for high-school use. The work is gracefully written in dialogue-form: but the contents are too technical to be touched upon in our space. We must confess, that, after one reading, we are still in some doubt as to whether Miss Handley's pages have brought Mr. Hodgson within range of those for whom his own are too abstruse.

NOTES AND NEWS.

A TELEGRAM from Dr. Swift, dated Dec. 27, announces the discovery of a comparatively bright telescopic comet, by Mr. W. R. Brooks, at Phelps, N.Y., an easterly motion being 'strongly suspected.' The discovery is confirmed by an observation at Harvard on Dec. 28. The comet is circular, about 3′ in diameter, equivalent in brightness to a star of the ninth magnitude, and it has a strong, eccentrically placed condensation, but no tail. The position given by Professor Pickering for Dec. 28.4684, Greenwich mean time, is, R. A. $19^h\,59^m\,27^s$; Dec. + 4° 31′ 34″; so that the comet would now set, in this latitude, about three hours after the sun.

— 'Short studies from nature' (New York, *Cassell*, 1885) is one of many books intended to interest general readers in the later scientific discoveries. Six of the ten chapters treat of zoölogical subjects, bats, dragon-flies, oak-apples, birds of passage, glow-worms, and Foraminifera. They are generally well written, and contain much that is interesting in a readable form. They treat mainly or entirely of English animals; but in most cases the notes and description would apply equally well, with a change of specific name, to our American representatives, and be equally interesting to our American readers. There are also chemical and astronomical chapters, and one on caves.

— Any book which will draw the attention of young or old to the habits of common animals deserves all encouragement. We have a few such already; but any one who has examined other books of this class will find, on comparison, that Holder's work ('Marvels of animal life,' *Scribner*, 1885), while compact, has a wider scope, and contains a large amount of fresh material. Very many of the animals described are not members of our fauna; but there are enough familiar forms described to encourage us to study the habits of more of our common animals, and to hint of the possibility of interesting discoveries awaiting patient observers. The fact that the writer has been an eye-witness of most which he describes, makes his work entirely different from the mere compilations of which most similar books are composed, and makes one almost forget while reading that he is not himself an eye-witness. The writer's style is fresh and attractive. It will surprise some readers to see man and the Pteranodon represented on plate xxxi. as contemporaneous. Possibly, however, the supposed human figure may not be that of a man: it might easily be almost any thing else. The plates, unfortunately, never accompany the description, but are the reward of patient search.

— The prize of 500 francs left by M. A. P. de Candolle is offered by the Société physique et d'histoire naturelle, of Geneva, for the best unpublished monograph on a class or family of plants; the essays written in any of the four great European languages or Latin, to be sent in on Oct. 1, 1889.

— A catalogue of the printed maps, plans, and charts in the British museum has been prepared by Professor Douglas, and will be issued in two large volumes.

— An Italian ship has been sheathed with glass plates, cast like iron plates, so as to fit the hull, to take the place of copper sheathings. The joints of the plates are made water-tight by the use of waterproof mastic. The advantages claimed for glass over copper are its insensibility to oxidation and its exemption from incrustation.

WASHINGTON LETTER.

AT the last meeting of the Philosophical society the evening was devoted entirely to the election of officers for the ensuing year, and the reception of the annual reports of the secretaries and treasurer. The report of the secretaries included some comparisons of the work of the society in 1885 with that of 1884, a *résumé* of which will doubtless be of interest to many readers of *Science* who are connected with scientific societies in other parts of the country.

The number of new members admitted in 1885 was 20, while in the previous year 35 were added to the roll. The total active membership has increased from 173 in 1884, to 183 at the close of 1885. Sixteen meetings were held in 1885, one more than in the previous year. The average attendance at these meetings has increased from 42 in 1884, to 48 in 1885, showing a considerably greater percentage of increase than that in the active membership. The number of papers presented was the same in both years, being 32; while the number of persons taking part in the discussions increased from 38 to 41. The 'general committee,' which transacts most of the business of the society, consists of 17 members. The average attendance at the meetings of this committee was 11.9 in 1884, and 12.1 in 1885.

To this exhibit ought to be added that of the mathematical section of the society, which held six meetings in 1885 with an average attendance of 15, these numbers being identical with those for the previous year. The section received 11 papers in 1884, and 14 in 1885.

Altogether the showing is indicative of steady progress. In round numbers, it may be said to enroll two hundred active members, and at any of its meetings one is tolerably certain to find as many as fifty people.

The report of the treasurer was also satisfactory, showing the financial condition of the society to be excellent. It must not be forgotten that within a few years three vigorous societies have 'swarmed' from this, including the anthropological, biological, and chemical societies of Washington, and that one or two of them are larger than the parent society. By careful attention to the character of the papers presented, the committee on communications has prevented specialization, and has thus succeeded in retaining the support and loyalty of those interested in all departments of science. The philosophical society is not yet fifteen years old, but it promises to be one of the three or four leading scientific societies in the country.

The joint committee of congress for the consideration of the scientific bureaus of the government continued its work up to the holiday recess. It is said that the geological survey was recently the subject of a searching investigation at its hands, the examination having to do principally with business methods and financial transactions. As stated in a previous letter, the recent addresses of the retiring presidents of some of the societies were devoted, in some degree, to the consideration of the absorbing question of the relation of the government to scientific work; and it is known that at least one member of the joint committee availed himself of the opportunity then afforded to learn something of the views of representative scientific men, expressed with that freedom from restraint which is characteristic of communications of that nature. The committee is expected to report in January.

The 'star-eyed goddess of reform,' as represented by the auditors of the treasury department, very properly shows herself to be blind to the existence of party lines or political affiliations. Commissioner Coleman of the agricultural bureau has recently had an account suspended against him, amounting to $1,800, arising out of the purchase of seeds for distribution by members of congress among their constituents. The purchase was made very soon after his appointment, and appears to be precisely similar in character to those which gave rise to the much larger discrepancy in the accounts of his predecessor, Commissioner Loring. It will not be regretted if the adjustment of these accounts leads to a revolution in the manner of conducting the seed-business in the department, which has for many years diverted a large part of the annual appropriation from channels in which it might have been made tributary to the real progress of agriculture.

The friends of Dr. Emil Bessels will regret to learn of the loss he has sustained in the burning of his residence in Prince George county, Md., not far from Washington. The fire occurred on Christmas morning, and it is stated that the doctor himself had a narrow escape. The principal and irreparable loss was his library, which is said to have been entirely destroyed. It included a large collection of rare and costly scientific books, valuable manuscripts, and arctic charts. Z.

Washington, D.C., Dec. 28.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The temperature of the moon.

THE interesting article by Mr. Ferrel in your issue of Dec. 18 seems to require some words of comment for the general reader, who may not otherwise notice that the whole reflected heat (and light) of the moon appears to be there omitted from consideration. Moonlight is the ocular evidence that a part, at least, of the moon's heat is lost by reflection, since what is light to the eye is heat to the thermoscope. In fact, what we see is but about one-third of what is reflected; and all of this must be subtracted from what the sun sends the moon before we have as a remainder the amount radiated from its surface, which is treated as the whole sum in the article under discussion.

It is there assumed that the moon loses heat by radiation only; but, even in this hypothesis, the highest temperature assigned to its sunlit surface is but little above that of boiling water. Since, then, bodies only begin to be visible by radiation at a red heat, it follows from this hypothesis that the full moon would always be black and invisible, — an imaginary moon, and not the moon which we see. Mr. Ferrel is doubtless aware of this, and in his own view may be supposed to be purely treating of a hypothetical body; but the ordinary reader is certainly apt not to understand the strictly limited premises with which he starts.

In the exactness and competence of Mr. Ferrel's mathematical treatment of this or any subject he presents, all will agree; but the more exact the logical instrument, the more certain it is to deduce limited conclusions from limited premises.

Without entering on any discussion of Mr. Ferrel's use of Dulong and Petit's formula, I may then say that to those astronomers and physicists who are engaged in the task of experimentally determining the actual temperature of the lunar surface, the existence of this great amount of reflected heat is an enormous difficulty, for it is not until this has been differentiated from the radiated heat that the temperature of the actual surface is either theoretically or experimentally ascertainable.

To the present Earl of Rosse belongs the credit of making the first attempt to do this, and, in doing so, to conquer those experimental difficulties which lie even at the threshold, and which alone are excessive; for the total amount of all the heat of both kinds is so minute as not to change the reading of a thermometer directly exposed to the rays of the full moon by nearly so much as the thousandth part of a centigrade degree.

The writer has now been engaged for a long time in these researches, whose interest and importance to us are not to be measured by the minute amount of the heat in question.

To prevent mistake, let it be stated that there never has at any time been any doubt but that the lunar surface radiates heat toward us, and there is scarcely a doubt but that this radiated heat is greater than the reflected. The question is, however, as to the amounts, and as to whether the first kind passes through our atmosphere as well as the second.

This is not the place to discuss this somewhat recondite point; but the as yet unpublished Allegheny observations, now conducted through over twenty lunations with the object of discriminating the reflected from the radiated heat by the formation of a lunar heat-spectrum, show that a considerable part of this radiated heat does pass through our atmosphere along with that reflected. While the writer differs from the conclusions of Lord Rosse as to the temperature of the lunar surface, it seems due to truth to say, that, in the particular just alluded to, the interpretation of Lord Rosse is sustained more fully than his own first one.

Without anticipating the publication of these experiments, the reader may care to learn of one observation made on the rare occasion when the full moon is partially dark; that is, during an eclipse. In the lunar eclipse of Sept. 23, 1885, about eight-tenths of the moon's diameter was covered by the umbra. The night was beautifully clear at Allegheny, and observations were made with the bolometer on different parts of the lunar image formed by a concave mirror of twelve inches aperture, and ten feet three inches in focal length, which was kindly loaned for the occasion by Mr. J. A. Brashear. The image was a little over an inch in diameter, and the bolometer was limited by a diaphragm to an aperture of about three-tenths of an inch; so that any circular portion of the moon's surface forming about one-eleventh of the whole could be examined independently of the rest. Previous observers have been obliged to utilize all the lunar rays from a large concave mirror in forming a very small image barely covering the thermopile employed; but, owing to the superior delicacy of the bolometer, it has thus become possible to select small portions of a comparatively large lunar image for separate study, and still have heat enough for accurate measurement.

Before the eclipse began, the exposure of the bolometer to the central portion of the image produced a galvanometer deflection of one hundred and eighty divisions. The deflection on the east limb of the moon was one hundred and sixty-four divisions; but, as the eclipse advanced, the deflections here fell off very rapidly, the diminution being noticed before the penumbral shade became certainly visible to the eye. The diminution of the effect on the centre and west limb followed that on the east limb in time, as these regions were progressively covered by the shadow. On portions covered by the umbra the deflection was very small, varying from four divisions soon after the beginning of immersion, to scarcely more than a single division of the galvanometer scale shortly before emersion from the umbra; so that the deflection was with difficulty detected. This last minute effect might have been due to true radiation from the darkened lunar surface, or possibly to diffuse and irregularly reflected heat from the surface of the mirror, though the method of exposure was calculated to eliminate this source of error as far as possible, — a doubt which must be resolved by future experiment.

As the middle of the eclipse approached, measures made just outside the edge of the umbra indicated an increasing transmissibility by glass for the feeble radiant energy remaining. Thirty minutes before the middle of the eclipse, the transmission by glass for the lunar heat rays at this inner edge of the penumbra was found to be thirty-two per cent, and fifty-five minutes later it had increased to forty-eight per cent. Although these latter deflections were very small, the observations were apparently trust-

worthy. The average transmission of the lunar rays by glass during the eclipse was about twenty-two per cent, and did not differ very materially from that for the uneclipsed moon on this day. If the increased transmissibility at the outer edge of the umbra be a real effect, it is possibly local and evanescent.

The deflection obtained from a portion of the lunar surface just in advance of the umbra did not very materially differ from that given by a similar portion over which the umbra had just passed.

Clouds, preventing further observations, began to form as the penumbra was about passing off. There were indications, however, of a recovery of heat nearly as rapid as the previous fall. This effect was shown, though in a less marked manner, by Dr. Boeddicker's observations, in the eclipse of Oct. 4, 1884, made at Lord Rosse's observatory (see *Nature*, xxx. p. 589).

The following are the deflections observed on each point during the progress of the eclipse at Allegheny:

	Deflection.	Time.	Time from mid-eclipse.		Deflection.	Time.	Time from mid-eclipse.		Deflection.	Time.	Time from mid-eclipse
		h. m.	h. m.			h. m.	h. m.			h. m.	h. m.
East	164	11.53	2.35	Centre.	180	12.01	2.27	West	155	12.16	2 12
"	125	12.26	2.28	"	128	12.44	1.44	"	153	12.32	1.56
"	45	12.58	1.35	"	101	1.06	1.22	"	129	12.58	1.30
N.E.	4	1.28	1.00	"	31	3.49	1.21	"	21	4.05	1.37
S. E.	71	3.43	1.15								

The salient feature of these observations is, we need hardly say, the extraordinary rapidity with which the lunar surface parts with its heat, most of that which is radiated disappearing all but simultaneously with that reflected. S. P. LANGLEY.

Allegheny observatory, Dec. 23.

Sir William Thomson to the coefficients.

I know of no easier way to reach those for whom the enclosed message was especially intended than through the columns of *Science*. At the same time, I believe it will be read with great interest by many who were not of the somewhat limited number referred to. To such, a brief explanation may be due: —

At the close of the course of lectures by Sir William Thomson, at Baltimore, in October, 1884, it was determined by those who, through the courtesy of the Johns Hopkins university, had enjoyed the privilege of listening to the course, to present Sir William with a memento of the occasion which had been, to them, of such unusual interest. Under the circumstances, nothing could have been more fitting for this purpose than one of Professor Rowland's large concave gratings, which was accordingly agreed upon. Several months were required for the manufacture and examination of a grating which was entirely satisfactory to Professor Rowland; but early in the past summer it was completed, and transmitted to Sir William Thomson through the kindness of the secretary of the Smithsonian institution.

Prof. George Forbes of London was present during the course of lectures, and Lord Rayleigh attended a number of them. In the equations of motion developed in the work there appeared twenty-one coefficients, agreeing in number nearly, if not exactly, with the number of persons in regular attendance upon the lectures. This relation was quickly noticed by some one, and was made the basis of some humorous verses composed by the genial and witty Forbes, which were read at a reception given to the class by President Gilman, and were afterward published. Their title was "The lament of the twenty-one coefficients in parting from each other and from their much-esteemed molecule."

The first stanza began, —

> "An aeolotropic molecule was looking at the view.
> Surrounded by his coefficients, twenty one or two;"

and the whole will always possess much interest to those who were present. With this explanation, I justify the title which I have given to the following selections from a letter recently received from Sir William Thomson. T. C. M.

Washington, D.C., Dec. 28.

I wrote to Professor Rowland, acknowledging the receipt of the grating; but I ought before now to have thanked all the other coefficients for their kindness in giving it to me. I should feel greatly obliged if you would transmit to those of the coefficients who are in America my heartiest thanks for their great kindness, and say to them that the grating will be a permanent memorial to me of the happy three weeks of 1884, when we were together in Baltimore. . . . After the British association meeting at Aberdeen, I was delighted to be able to show the grating to some of our English appreciators, — including one of the coefficients, George Forbes; and Lord Rayleigh, whom we may consider as, at all events, a partial coefficient; and Professor Fitzgerald of Trinity college, Dublin; Oliver Lodge of Liverpool; Glazebrooke of Cambridge; and Captain Creak of the compass department of our admiralty, — who came to stay with us at Netherhall, our country house, for a few days, on their way south. We had no sunlight to work with, but we got the double sodium light in the first and second spectrums from a salted spirit-lamp flame exceedingly well, and we were all delighted with the result. I had never myself seen any thing like it before. WILLIAM THOMSON.

The university, Glasgow, Dec. 5.

A waste of public money.

My attention has just been drawn to your notice in *Science* of Dec. 4, of my forthcoming report on irrigation. The substance of your criticism is that quantity, and not quality, appears to have been the object in its compilation, — that the work should have been written in one volume instead of three; and you quote a long, redundant paragraph as a sample of the composition throughout.

It is to be regretted that you undertook to criticise an entire report, when you had before you only some advance sheets of one volume, very hastily printed from unrevised manuscript, solely for the purpose of an exhibit to the legislature, which desired to know something of the scope of the work.

The entire report, as ordered printed, is now under way; and I believe you will find, when you receive a copy, a decided improvement in the literary construction which you have criticised. As for the general make-up of the work, — its fulness, and occasional repetition of matter under different headings, — which you do not specially refer to, but probably have noticed, I shall have something to say at the

proper time and place. In the mean while, the many kindly, encouraging, and sometimes flattering words of approval which I have received from persons who have read the 'advance sheets' you criticise, and whom I believe to be specially qualified to judge of a work on this subject, will sustain me in the labor of completing it as begun.

You have criticised a work projected on one plan, and to fill a demand amongst irrigators and persons, from one cause or another, interested in the details of the subject, as though it purported to be on another plan, and for general circulation and sale. When the first volume is published, I hope to make this clear to you. It has always been the intention to bring the more important matter of general interest in this report within the compass of one moderately sized volume, to meet the demand of which you speak. This was the subject of a recommendation to the legislature, in my biennial report transmitted with the advance sheets of the final report; and I am glad to tell you that there will be submitted to the legislature at its next session (January, 1887) a concise and readable report for general circulation, in addition to the more voluminous books of reference.

WM. HAM. HALL,
State engineer, California.

Sacramento, Cal., Dec. 22.

The Davenport tablet.

As the evidence in regard to the limestone tablet indicates that it was a plant made to deceive the members of the Davenport academy, we are led to inquire whether the authenticity of the shale tablets rests on any better foundation. Accepting the statements in regard to their discovery as published in the Proceedings, and referring to the excellent albertypes on plates 1, 2, and 3, vol. ii., we notice the following facts calculated to arouse suspicion: —

On the so-called 'cremation scene,' plate 1, vol. ii., are three Arabic 8's, one so much like that on the limestone tablet as almost to lead to the belief that the two were made by one hand. Moreover, there are, as admitted by the finder (vol. ii. p. 223), four other characters on the latter identical with characters in the 'cremation scene.' This links the two so closely together as to induce the belief that they belong in the same category, and hence that the conclusion reached in regard to the limestone tablet must apply to all the shale tablets, as the latter were found together in the mound known as No. 3 of the 'Cook farm group.' It is also stated in the Proceedings (vol. ii. p. 223), that the bird-figures on the limestone tablet "have each a bit of quartz crystal set in for an eye, *like the eyes of the animal figure from mound No.* 3, . . . and, like those, they are held in place by a white cement of some kind." This animal figure was found in the dirt thrown out of mound No. 3, from which the shale tablets were obtained (vol. ii. p. 256). It is therefore almost impossible to avoid the conclusion that all must stand or fall together.

No. 3 appears to have been a double mound, the southern portion only having been explored in 1874; the northern part (in which the shale tablets were found), not until 1877. According to Dr. Farquharson (vol. i. p. 119), the part first opened contained no layers of shells or stones; and no mention is made of an excavation or grave in the earth beneath, nor does the figure (No. 3, plate 2, vol. i.) show any stratification or grave. Turning to the figure of the same mound (vol. ii. p. 92), we find both strata and grave represented in this southern portion. Mr. Gass, in his subsequent account (vol. ii. p. 92), says some errors were made in the first description and illustrations; but Dr. Farquharson says his description was made from Mr. Gass's statements, and partly from personal observation on the spot (vol. i. p. 118). Attention is also called to the fact that the skeletons of the intrusive burial over the southern grave, as well as the three in it, were whole and undisturbed; while over the northern grave the human bones of the intrusive burial were scattered through the soil, and with them the fragments of a brass ring; while in it, beneath the shell stratum, were "fragments of human bones and small pieces of coal slate or bituminous shale" (Mr. Gass's account, Proceedings, vol. ii. pp. 95, 96). In the plan of the mound (fig. 9, vol. ii. p. 93), a single skull is represented in this northern grave where the tablets were discovered. This condition of the contents is scarcely consistent with the idea that there had been no previous disturbance of this part of the mound.

The tablets were not discovered until five o'clock in the afternoon (Jan. 10), "*covered on both sides with clay, on removal of which the markings were for the first time discovered*" (vol. ii. p. 96), yet we are informed which side of each was upward as they lay in their resting-place.

It may not be out of place to call attention to the fact that nearly all of the letter characters of the 'cremation scene,' as represented on the albertype, may be found on p. 1766 of Webster's unabridged dictionary, edition of 1872, or any subsequent edition, where the letters of the ancient alphabets of the old world are figured. A few, it is true, are reversed, and in some instances the form is slightly varied; but the resemblance in most cases is very strong. The reader can make the comparison for himself; but I would call his attention to the fact that in the upper of the two transverse curved lines, near the right-hand end, the two forms of the 'Gallic' *O appear together*, just as given on the page of the dictionary. He will also observe that in some instances a number of characters in close relation on the tablet are found near together on the page of the dictionary; here, also, we find the 8 so often used on the tablets. A photograph or the albertype must be used for this comparison.

It is true, letters of almost any form can be found on this page, but it would be an anomaly to find a brief ancient inscription consisting of letters from half a dozen alphabets of widely different ages, and partly of the angular and partly of the cursive types. That this is true of this inscription, is readily seen by the suggested comparison. Dr. Seyfforth, in his attempt at an explanation, published in vol. iii. of the Proceedings, was forced to go to half a dozen or more alphabets to find the letters given in this single short inscription.

The tablet represented in plate 3, vol. ii., and known as the 'calendar stone,' indicates, beyond any reasonable doubt, contact with people acquainted with the twelve signs of the zodiac. This is admitted by Dr. Farquharson (vol. ii. p. 109) and Dr. Seyfforth (vol. iii. p. 77), and necessarily forces us to the conclusion that it is post-Columbian, or the result of contact, possibly at some very ancient date, with people of the eastern hemisphere.

The fact that the diameter of the inner circle is

exactly two inches, of the next three and a half inches, and next to the outer one five inches, 'certainly has a modern look,' as Dr. Farquharson truly remarks (vol. ii. p. 109). The reader is doubtless aware that among the illustrations in the latter part of the dictionary mentioned is a figure of the zodiac with four rings or zones (p. 1704).

These facts, gathered from the statements and figures published in the Proceedings of the academy, are presented for consideration by our antiquarians. The question of the authenticity of these relics should, if possible, be definitely settled, as they have, if genuine, an important bearing on some troublesome archeological problems. CYRUS THOMAS.

Dr. Otto Meyer and the south-western tertiary.

In the December number of the *American journal of science*, Dr. Otto Meyer publishes what purports to be a reply to criticisms on his attempt to prove that all observers previous to himself have been mistaken as to the broad facts of the succession of the tertiary strata of the south-western states, and that what Lyell and the American geologists have found to be the top is really the bottom, and *vice versa*. This is the third of three lengthy papers devoted by him to the same theme; and one would naturally suppose that one who is allowed to occupy so much space in a scientific journal of such high standing had at least some new observations of his own to communicate, upon which to base so sweeping an assertion; and that he had studied and candidly considered the published work of his predecessors. His second paper showed the extremely limited extent of his own observations, and his failure to even read, much less study, the literature of the subject, from which he quoted only disjointed sentences, selected to suit his ideas. The three articles in the October number of the journal, from three observers whose observations he calmly sets aside as unworthy of confidence beside his own superior lights, expressed their astonishment at the cool assumption, grounded on such a slender basis, that pervades Dr. Meyer's methods and assertions; and they gave a few of the simple facts that irrefragably prove the correctness of the recognized succession of formations.

In his latest article, Meyer goes even farther than before. He not only denies categorically that stratigraphy alone, including dips, can give any certainty as to the natural succession of the formations, unless we could 'follow the strata foot by foot;' but he proceeds to pick out from the work of myself and others such portions as leave room for doubt in their interpretation, and upon these constructs and supports his fanciful fabric. He simply ignores facts pointedly stated, that completely overturn his whole scheme; as, for instance, the paragraph in which I state the fact, verified innumerable times, that the sandstone of the Grand Gulf group is found "*overlying* the Vicksburg strata generally along the southern line of the Vicksburg group." In the face of this statement, which, if he had chosen, he could easily have verified near the very localities examined by him at Jackson and Vicksburg, and of the universal and patent fact that all the divisions of the Mississippi tertiary disappear beneath the drainage-level with a southward or south-westward dip, he presents for acceptance by guileless American geologists a section in which the Grand Gulf rocks are made the base of the tertiary. In referring to the re-appearance of the Jackson shell bed at one point on the Chickasawha River, southward of the main belt, he entirely overlooks the fact that it is there directly overlaid by the most characteristic 'orbitoides limestone' of the Vicksburg group, under which it disappears to southward.

Similar methods are pursued in other cases, varied with elementary platitudes concerning the general value of lithological and paleontological characters.

I cannot consent to cumber the columns of this or any other journal with a detailed refutation of assertions founded upon such methods of procedure. Whenever Dr. Meyer or any one else shall come forward with any thing tangible that seems incompatible with the results deduced from my elaborate researches in the south-western tertiary, I am ready to discuss the issue; but I am unwilling to waste time, paper, and ink upon the flimsy but elastic structure which Dr. Meyer has, in the face of known facts, evolved from his inner consciousness. Fortunately, the geological area which he attempts to turn wrong side up is now again under examination by competent observers, who have no hobby to ride, and whose results, I have reason to hope, will be made public before many months. In the mean time, I commend Dr. Meyer's methods to the attention of ambitious young geologists as a conspicuous example of 'how not to do it.' E. W. HILGARD.

Berkeley, Cal., Dec. 15.

A new meteoric iron from West Virginia.

In your last issue appears a communication entitled 'A new meteoric iron from West Virginia,' in which a meteorite said to have been found near Charleston, Kanawha county, W. Va., is described.

The writer is evidently not aware that this same piece of iron was described in a paper read at the meeting of the American association for the advancement of science, held at Ann Arbor in August last. The transactions of that session are not yet published, but the title of the paper above mentioned was noticed in *Science*, vi. No. 136, p. 222, Sept. 11, and in the *American journal of science*, xxx. No. 178, p. 326, October, 1885. No mention would be made of this oversight if the iron were correctly described, but several inaccuracies demand attention. When the paper was prepared, the only information at my command was that furnished me by Dr. H. G. Torrey, and was simply this: that the iron had been sent to him from Charleston, Kanawha county, W. Va., by Major Delafield Du Bois, who wished to have it assayed. The major had received it from parties who thought it precious metal of some kind.

Since this first report was made, Major Du Bois has looked up the matter more thoroughly, visiting the true locality, and making many inquiries. At a meeting of the New York academy of sciences, Nov. 30, the writer read a paper, announcing the full particulars of the finding. Owing to press of matter, this paper will not appear in the *American journal of science* until February, and in the New York academy proceedings as customarily published. I then announced the true locality to be Jenny's Creek, — a fork of the Big Sandy River, 15 miles from the Chatteroy railroad, 35 miles from Louisa, Kentucky, and 38 miles from Wayne Court-house, Wayne county, W. Va., not Kanawha county, as formerly announced. Your correspondent says, "Of its chemical constitution and the circumstances of its fall, we are quite ignorant." He further asserts that

the iron was devoid of any thing like a crust. I would repeat that the iron was found in October, 1883, in two masses aggregating at least twenty-five pounds in weight, and that both these masses were covered with a crust. I presented an analysis of the iron made by Mr. James B. Mackintosh of the School of mines, New York, and also cuts showing two views of the iron, and one of the crystalline structure of its surfaces. The iron which I described is unquestionably that mentioned by the writer in your last issue.

Instead of being found near Greenbrier county, it was found two counties farther off, or one hundred miles. Hence it is scarcely credible that all these pieces are fragments of a meteorite which burst in mid-air.

It is exceedingly important in the study of meteorites that wrong localities should not creep into print. If this instance were allowed to pass unnoticed, it would result in the recording of two distinct falls; i.e., one at Charleston, Kanawha county, W.Va., and the other at Jenny's Creek, Wayne county, W.Va. The two small pieces brought to me from Wayne county are identical with the original piece loaned to me for description, and the danger of meeting with these remaining fragments as supposed new finds was touched upon in the paper read at the Academy of sciences. GEORGE F. KUNZ.

A national university.

In No. 149 of *Science* (Dec. 11), in an article on 'A national university,' is a criticism upon that part of the report of Secretary Lamar recommending the establishment of a national university in Washington. The writer urges that there must be "a fatal defect in any congressional bill to establish a university, so long as the principles of appointment to United States offices, and the tenure of those offices, remain what they are." The writer is ignorant of the fact that we now have established in Washington, by congressional bill, the Columbia institution for the deaf and dumb and the Howard university. Both of these institutions, in their present form, were established by congress, and are supported by yearly appropriations. No greater degree of permanence in tenure of office is found in any university of the country than in these, and no difficulty is experienced in finding competent and able professors and instructors.

The next objection is, that "the government of a national university would necessarily be in the hands of some board of officers, and the constitution of such a board would lead to many difficulties."

We supposed that all universities were in the control of some board, and in almost every one of our large universities the constitution of such a board has led to many difficulties: the board of Yale college is now no exception. The Smithsonian institution is controlled by a board of officers appointed by congress, and it has not led to the difficulties suggested. The influence of sectional feeling has not been felt, and we doubt if any plan could have been devised by which more good could have been accomplished than has been by the board of the Smithsonian, with Professors Henry and Baird as its secretaries.

The writer objects that "the gift of such an education would rest in the hands of the members of congress, and would only place so much injurious patronage at their disposal."

There would be no necessity for any thing of this kind. Such patronage does not exist either in the Columbia institution or the Howard university; but, even if it should rest in the members of congress, the results in analogous cases prove that the objection has no weight. The appointments both to West Point and the Naval school at Annapolis are in the gift of the members of congress, and there are no institutions of the kind in the world where abler men or better scholars have been graduated. These institutions have educated and trained commanders of the army and navy, and they have in war and in peace shown the excellence of their education.

The last objection is, that a national university would be un-American in principles. Washington, Jefferson, Madison, and Adams thought a national university was necessary. We do not understand how an institution which the founders of our country recommended can be considered un-American.

There is no place in the country which possesses such advantages for a national university as Washington. Here are the Smithsonian institution with its various departments, the geological survey, the coast survey, the nautical almanac, the hydrographic office, the signal-service bureau, the national museum, the medical museum, the patent office, the libraries in the various departments, and the congressional library, — each of these bureaus presided over by gentlemen of the highest ability, aided by a corps of men the equals of those of any of our universities; the whole forming a nucleus for a university, when grouped together and combined, superior to any in the world. Washington is the capital of the country, and is to-day a centre of more scientific apparatus and more scientific men than any other city in the union. G. G. H.

It is perhaps unnecessary to point out the difference between a 'national university' and a university incorporated by act of congress.

I think the writer of the above letter must be unaware that the absolute permanence of tenure of office during efficiency is the one great inducement which leads young men of good parts to enter the service of such a college as Harvard. It goes without saying, that it would be out of the question to induce one of the full professors at Harvard, except for much larger pay, to give up his reasonable salary, his position for life, and his comparative freedom from the necessity of explaining his work to unsympathetic critics, to accept a position under the United States government, where he could, by constitutional provision, only be sure of his salary and place from year to year; whereas I know of the anxiety felt by instructors in colleges under city control to escape from their bondage to the politician.

It is true that there are a large number of scientific men in government employ, but they are there for the simple reason that there is the one great market for their services. It has never been my fortune to meet with any teacher who would not prefer to be in the employ of a private school or college, rather than in that of city, state, or United States. The constant parleying with politicians which government employ entails is simply unbearable for many of the men, whose disposition leads them to choose the teacher's life.

The scientific bureaus were established by the United States with the view of making surveys of the country, and the work of scientific investigation is carried on at present only with the object of mak-

ing such surveys possible. It is a step in a radically new direction to introduce the prosecution of investigation *per se;* and it should be well considered where this begins, and whether it is the proper function of the government to prosecute such work. The establishment of a teaching university is a still greater step.

There is further, in my opinion, no need of a university in Washington, as we already have as good an institution as could be wished at the neighboring city of Baltimore.

An appeal to the prestige of the names of the statesmen of the early days of the country is always to be deprecated. We are suffering at the present time from a law passed under the hurrah raised by a similar appeal. L. S.

Some points in the evolution of the horses.

The main facts with regard to the evolution of the horses have long been known, and the series of modifications in the limbs, skull, and molar teeth, so fully described, that little doubt remains as to the various links in the long chain. But, in tracing out the line of descent of any group of organisms, it is not only necessary to follow out the steps of progression in a general way, but in all their details. In the case of fossils, this must, for the most part, be done by many different observers, as so much depends upon the fortunate discovery of good specimens. The present note gives a small contribution of this kind to the elucidation of the history of the horses.

The earliest member of the series of which we know much is the Hyracotherium of Owen (Orohippus, Marsh). This little animal is quite abundant in the lower eocene of Wyoming, and has been very fully described by Professor Cope. In this genus (fig. 1) the incisors are arranged in a semicircle,

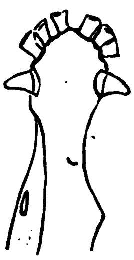


FIG. 1. — Lower incisor and canine series of Hyracotherium (after Cope). One-half natural size.

FIG. 2. — Lower incisor and canine series of Anchitherium (after Kowalewsky).

either uninterruptedly or separated by slight intervals. They are simple teeth, with sharp, chisel-shaped crowns. The canines are small, conical, and everted. The symphysis of the lower jaw is long and much contracted, rounded and somewhat expanded at the end.

The next type in the series is the Mesohippus of Professor Marsh, from the White River beds or lower miocene. Although the characters which Professor Marsh gives as separating this form from Anchitherium are either inaccurate or not of generic value, Mesohippus must, as we shall presently see, be regarded as a distinct genus. Here the shape of the mandibular symphysis and of the incisor teeth is very much as in Hyracotherium. The incisors are small, with rather broad, chisel-shaped crowns, and without a trace of an invagination of the enamel. The advance from Hyracotherium to Mesohippus consists chiefly in the increased size of the animal, reduction of the number of digits, greater complexity of the premolar and molar teeth, and enlargement of the brain. Specimens of Mesohippus with the incisors in position are rather rare. The description given above is of a small species (No. 10,246 of the Princeton museum) which was obtained by the Princeton scientific expedition of 1878 at Chalk Bluffs, Colorado.

In the upper miocene deposits of the Pacific coast the true Anchitherium (Miohippus, Marsh) appears. In this genus the incisors show an invagination of enamel on the grinding surface of the crown. The pit so formed is shallow, and comparatively soon wears down to a scar. I have not had an opportunity of examining European specimens with reference to this point, but the presence of the pit is clearly shown in Kowalewsky's figures (*Memoires de l'academie imper. de St. Petersbourg*, 7th ser. tome xx. pl. iii. figs. 55 and 57). Of fig. 57 (see fig. 2), Kowalewsky says, "Les incisives mitoyennes présentent déjà les puits en émail qui sont si charactéristiques pour les chevaux." This pit, seen in its earliest stages in Anchitherium, goes on increasing until it reaches its greatest development in the recent genus Equus. It is of interest to see that even in this small and comparatively unimportant detail we find a fresh confirmation of the accuracy of previously expressed views as to the series of equine ancestors. If these determinations are accurate, they must, of course, hold good down to the minutest details. Further investigation will undoubtedly bring more of these minor correspondences to light. W. B. SCOTT.

Geol. mus., Princeton, N.J., Dec. 16.

Equatorial currents in star and planetary atmospheres.

In the 'Astronomical notes' contained in the number of *Science* for Dec. 11, occurs a statement in regard to the circulation of the earth's atmosphere which seems to me to require qualification, and I therefore venture to call your attention to it. The passage in question reads as follows: "As to the earth, we know that the general drift of the lower atmospheric currents is eastward, rotating faster than the globe itself; but of the circulation high up above the clouds we knew absolutely nothing until the red sunsets following the Krakatoa outburst . . . indicated, by their successive appearances at different places, a probable upper equatorial current moving rapidly westward, i.e., rotating slower than the earth."

Now, it is well known that the eastward movement of the atmosphere is confined to the temperate zones, and is not observable in the polar or tropical regions. On the contrary, the most striking feature in the circulation of the atmospheres is the great equatorial wind-current which flows from *east to west* along the equator, and is felt beyond the tropics of Capricorn and Cancer. It is about 60° in width, and therefore covers one-half the earth's surface. It is also, as I believe, the most important factor in the whole system of oceanic and atmospheric circulation, since, by the friction of its movement over the ocean surface, it produces the great equatorial water-current which is the chief, though not the only, cause of all the great movements of oceanic waters. The

cause of this equatorial wind-belt is probably the lagging-back of the loosely cohering and adhering atmosphere over the equatorial region, which has a maximum motion of rotation from west to east of about a thousand miles an hour. The equatorial wind-current has a motion westward of from five to ten miles an hour, but this is only relative to the surface of the earth, since it has an absolute movement eastward with the earth of perhaps 990 to 995 miles an hour.

The lagging-back of the atmosphere over the tropical regions may be altogether due to its inertia, or it may be in part the effect of friction with that real but intangible medium which fills the interstellar spaces, — the luminiferous ether. Whatever the cause of the equatorial wind-current may be, its importance in the physics of the globe cannot be exaggerated. Among the other phenomena with which it may be credited are the red sunsets which are now generally believed — as stated by the editor of your astronomical column — to be due to the projection into this equatorial current of an immense volume of volcanic dust from Krakatoa, which has not only floated many times around the earth, but has been widely diffused north and south of the equator by the high upper currents of air that flow from the equator toward the poles, and constitute the other great factors in atmospheric circulation. Along the thermal equator the heated air is constantly rising, and is replaced by the cooler and denser air flowing along the surface from the north and south. This, coming from regions where the rotation of the earth is much less than at the equator, reaches the torrid zone with a strong relative motion toward the west, — going slower than the earth, — and giving us the south-east trades of the southern side of the equator, and the north-east of the northern. The constant upward tendency of the air along the heated zone would retard the descent of the dust, and favor its suspension in the heaped-up mass of air which flows northward and southward from the equator. This air, which has an absolute eastward movement with the earth of perhaps 990 miles per hour, soon reaches a zone where the earth's movement is less than this, and where, with reference to the surface, the movement is toward the north-east in the northern hemisphere, and south-east in the southern. This, as is known to many, but perhaps not to all, of your readers, gives us the general drift of the atmosphere over the United States.

By the northward and southward flow of the tropical and dust-bearing air, that dust may be diffused over most of the earth's surface before it settles. J. S. NEWBERRY.

New York, Dec. 28.

Congenital deaf-mutism.

The chief requisite to racial experiments is isolation. A race of men is a breed, a stock, a strain that has been isolated long enough to fix by inheritance a number of characteristics. This isolation may be either geographical or social. Where caste prevails and marriage is confined to groups, the characteristics of each group will be fixed and perpetuated. This is social isolation, and the result is in the nature of a race. At the time when there were fewer people on the earth, and when the allurements to commerce and the means of locomotion were not so numerous, the present races of the world were fixed.

Prof. A. Graham Bell has on several occasions lately called attention to the formation of a race of deaf-mutes by caste isolation and intermarriage. A very interesting example of reaching a race of deaf-mutes by geographical isolation has just come to my notice.

Lieut. H. T. Allen, U.S.A., lately engaged in the exploration of Alaska, writes me as follows: —

"On two tributaries of the Koukuk River, Konootenah and Nohoolchintnah, both emptying from the south, and about seventy-five miles between mouths, were two villages about twenty-five miles from the respective confluences, the upper village 66°.40′ north, 150°.50′ west. One village contained six males, the other five; and, of these eleven, four were deaf-mutes. There was a woman who could speak fairly intelligently to her people, but could not hear. There was also a boy who was a deaf-mute. The natives said that the mutes had never been able to speak or hear, and the sounds emitted had nothing in common with the articulations of their relatives. I can account for the foregoing facts only by continued intermarriage, which is necessitated by their isolation. Above the upper village there are no tribes on the Koukuk River, none between the Nohoolchintnah and Konootenah, and none for many miles below the latter river. The men from these villages trade at the station on the Yukon River, near the mouth of the Tananáh. They claim to be Kleekots, but can readily converse with the natives of the Yukon from St. Yukon to Nulato." O. T. MASON.

The English sparrow.

Two years ago I published the fact in the *American naturalist* (September, 1883, p. 925), of the English sparrow having practically driven all the native birds out of the beautiful parks of New Orleans, when, even so long ago as that, this bird was to be found there in numbers. I distinctly recollect having seen them in Cheyenne, Wyoming, in 1877; so that I think this pest has spread more rapidly than some of the correspondents of *Science* are perhaps aware. Of course, the most important point at issue now, is to devise means for so reducing their numbers as to render them harmless in the future, or better still, if possible, to exterminate them entirely.

The methods suggested by Mr. Ralph S. Tarr (*Science*, No. 149) are excellent so far as they go; but I would suggest a far more efficient weapon than the shot-gun, for use in the city parks, recommended by him. I refer to the collecting cane now in use by many ornithologists in this country, with the seven-chambered pistol attachment. I have an excellent one by me now, belonging to the Smithsonian institution, and I will guarantee that I could kill 350 English sparrows with it in one day in New York City, and keep it up for every day in the year, or until their decreasing numbers reduced the average. It possesses several highly important recommendations over the shot-gun: it makes scarcely any noise; the ammunition is cheap; no danger is run of injuring persons in a crowded city; and it would attract far less attention. This weapon might be placed in the hands of those who proved themselves experts in its use, or any city police force. Other persons might also be licensed to use it, who were willing to practise exterminating the birds for a reward.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Dec. 18.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 1, 1886.

THE STUDY OF GEOMETRY.

We have a pernicious habit in this country of supposing, that, because in a republic all men are born equal as to their rights, they are also born equal as to their abilities. We have a different theory in regard to horses: we know that a race-horse is altogether different from a dray-horse, and we give him a totally different kind of life from the beginning. We have no trouble in recognizing him: we simply inquire who were his ancestors, and our expectation as to his qualities is carefully based upon the answer to that question. It would, perhaps, be a good plan if the young of the human species were divided into two groups at an early age, — one large and one small; one composed of those of whom nothing more than plain living is expected, and the other composed of the race-horses, of those whose ancestors, or whose chance endowments, give reason to hope that they may give some aid to learning or to culture.

There is. at all events, no reason why all young people should be taught geometry in the same way. For most children, a form of reasoning so abstract is not only repulsive, but very nearly impossible of comprehension. A little may be done for them (or for their descendants) by giving them a small dose of geometry, made as plain and easy and direct as it can be made; but they do not need to know every thing that can be done with the straight line and circle. Life is short, and the whole content of geometry as known to Euclid is long. For most children in schools, a good specimen of the kind of reasoning, and a fair knowledge of the principal results, are all that is desirable. For such, a geometry like Wentworth's serves a very good purpose.

But it is a pity that the kind of geometry a person is taught should depend upon his geographical position near this or that kind of a school. Any one whose destiny is to do difficult thinking in after-life should have a different kind of early training: he should dwell long among the geometrical concepts, should become thoroughly imbued with the bare and rigid form of reasoning, and should have the results as familiar as his mother-tongue. It is a serious loss to him if he is made to run over the subject with uncouth haste. Students of this kind will find their natural guide in such a text-book as Newcomb's or Halsted's.[1] In neither is it the aim to give the most rapid and cursory system possible. Both are written from the stand-point of the modern idea that the geometry of this world is not the only possible geometry, and that it is mere matter of accident that two parallel lines do not approach each other, and that two straight lines do not enclose a space. Both have felt the influence of the syllabus of the English association for the improvement of geometrical teaching. The idea of figure is shorn of its material content, and limited to its bounding lines or surfaces. The sum of two right angles is not regarded as a purely imaginary idea with no reality corresponding to it, but the 'straight angle' is allowed to play its natural part. In Professor Newcomb's book,·nis favorite idea is carried out of leading up to new and strange conceptions by very slow and gradual steps: Mr. Halsted's is intended for boys[2] of much more highly developed minds. There are no concessions to youthful weakness. It is also intended for boys of well-developed taste in the art of book-making. It presents a splendor of paper and of margin which is far removed from the republican simplicity of our ancestors.

The ancients believed that the geometrical concepts came down from heaven, but that the chief end of geometry was to measure the earth. We admit now that the concepts are, in the first instance, of the earth and earthy; but we have given an enormous development to the geometry of pure position, and have made it as remote from all possibility of application as the theory of numbers itself. It is in consonance with this development that in both these books measurement is given somewhat the position of an appendix to the subject, instead of being made to appear as the end towards which all the propositions lead up.

Mr. Halsted does an excellent thing in giving an introductory chapter on logic. When pure reasoning is about to become the student's daily occupation for many months, it is a pity not to give him a general view of the processes involved at the start. It

[1] *The elements of geometry.* By George Bruce Halsted. New York, *Wiley*, 1885. 8°.

[2] As a synonyme for 'student of geometry,' one should, however, say *girl* with the understanding that boys are to be included. Geometry is chiefly studied in the high schools, and the high-school graduates number three girls to every boy. If geometry is as good a specific against bad reasoning as is commonly supposed, logicalness will soon become a feminine instead of a masculine characteristic.

is very curious to find a compendium of logic with the syllogism left out. Hamlet is even less necessary to his play than the syllogism to logic. It is true, however, that the syllogism is an easy matter compared with inversion and contra-position. There is hardly a boy who is not greatly surprised to find that when he has proved that an isosceles triangle has two equal angles, it still remains to be proved that a triangle having two equal angles is isosceles. As De Morgan has pointed out, Euclid himself was apparently not aware that it follows every time from *A implies B* that *non-B implies non-A*.

In regard to 'his rule of inversion,' when three or more propositions are involved, Mr. Halsted has fallen into a slight inaccuracy. In the first place, if the term 'contradictory' is to be applied to three terms at all, it should be used in the same sense as when applied to two terms; the three terms should together cover the whole field, and they should not overlap. The word is a bad one for this purpose, however, and it is just as well to keep the two properties — that of being exhaustive and that of being incompatible — distinct.

In the second place, there is a redundancy in the rule as given by Mr. Halsted. From the three propositions,[1]

X implies x,
Y implies y,
Z implies z,

it may be inferred that

x implies X,
y implies Y,
z implies Z,

provided that *the subjects cover the whole field, and the predicates are incompatible.* It is not necessary that the subjects should be known to be incompatible, though it follows from the premises given that they are so, but also that the predicates are exhaustive. From the first two we have

X Y implies x y;

and, since there is no x y, there cannot be any X Y either.

It is very well worth while to have formulated the reasoning involved, instead of going through all the separate steps every time there is occasion for it, as the usual books on geometry do.

The conclusion does not follow if it is given that the subjects are incompatible, and that the predicates together fill the universe. The nature of the argument is most clearly seen in space. Lange believes that the logical laws of thought are derived from space-conceptions. Suppose there is a table painted in various colors, but so that

the red is all in the violet,
the yellow is all in the blue,
and the orange is all in the green;

and suppose, also, that the red, the yellow, and the orange together cover the whole table, and that the violet, the blue, and the green do not overlap: it follows that

red = violet,
yellow = blue,
orange = green.

To show how a somewhat complicated argument can be simplified by having this type of reasoning at command, we add a real illustration from algebra. In Descartes' method of solution of the biquadratic equation, the following relations are seen to hold between its roots and those of the auxiliary cubic: —

Roots of the biquadratic.		*Roots of the cubic.*
All real	*implies*	All real and positive.
Two real (unequal)	*implies*	One positive, two imaginary.
Two real (equal)	*implies*	One positive, two equal negative.
All imaginary	*implies*	One positive, two unequal negative.

But the division on the left is exhaustive, and the classes on the right are mutually exclusive: hence, by a purely logical *tour de force*, these propositions can all be inverted, and the desired inferences *from* the roots of the cubic *to* the roots of the biquadratic can be obtained at once.

Mr. Halsted's reviewers have pointed out before that he is deficient in a certain natural and becoming modesty. 'Two formative years' of his life is too high-sounding a phrase to be applied to any but a very great mathematician, like Professor Cayley, for instance.

CEREBRAL EXCITABILITY AFTER DEATH.

THE problems of brain physiology are so complex, and our means of studying them, especially in the human subject, so insufficient, that it is not to be wondered at if rather out-of-the-way and venturesome experiments are sometimes undertaken by the anxious physiologist; as, witness the actual stimulation of the exposed brain in a patient whose death seemed certain. Such an experiment is not apt to be repeated: and a few French physicians have now wisely set to work to study the results of stimulating the cerebrum, exciting the sense-organs, and subjecting the whole body to a vigorous examination in the case of criminals who have suffered death by decapitation.[1] Such investigations are not new; but the results have been, as a rule, either entirely negative, or brought out only a few rather obvious facts. In the experiments about to be described, the methods

[1] The letters stand for either terms or propositions.

[1] *Revue scientifique*, Nov. 28. By J. V. LABORDE.

of experimentation have been much improved, mainly by keeping up the spark of life, artificially, for a much longer time than was ever before accomplished.

A dog was prepared in such a way that a transfusion of blood from its carotid artery to one of the carotids of the head of the decapitated criminal could be promptly made, and thus a supply of living blood be made to flow through the lifeless head, and thereby preserve the excitability of the nervous apparatus. Into the other carotid (the right) of the head defibrinated blood at a suitable temperature could be injected. The head was received seven minutes after decapitation. The difficulty of finding the carotids in the soft tissues, which had become sadly disfigured by the decapitation, caused a loss of ten minutes. A small opening in the cranium was then made, so as to insert a pair of electrodes on the frontal parietal region of the left side, — the presumable motor centre for the facial muscles. At about twenty minutes after decapitation the double transfusion of blood was begun. The result was striking : a bright color returned to the face, which also assumed a natural expression. The effect was most marked on the left side, which received its blood-supply direct from the dog. The electrodes were inserted, but no result followed. Thinking this might be due to a stimulation of the wrong spot, they made another opening in the skull, and again stimulated the brain. This was followed by a regular and marked contraction of the muscles of the *opposite* side of the face, involving the orbicular and the superciliary muscles, together with a movement of the lower jaw, causing a strong chattering of the teeth. This effect could be repeated at will up to the 40th minute after decapitation, and, by increasing the current used in stimulation, to the 49th minute. After this no movement followed the application of the electrodes, although the facial muscles could be made to contract by direct stimulation of the muscles. The failure of the first stimulation was afterwards shown to be due to the unusual length of the head, thus causing an error of a few millimetres in the localization. At first the pupil could be made to dilate and contract by the approach or withdrawal of a strong light, — a fact frequently observed in previous cases. The peculiarities of the case are the great length of time for which the excitability remained, and the means employed for preserving this excitability, namely, the transfusion of living blood.

An opportunity of verifying these results presented itself in a subsequent case, but the results of cortical stimulation were negative. The explanation was offered, that the individual had furiously resisted the attempts of the officers to put his body in position for decapitation, and that the resultant neuro-muscular excitability prevented the orderly action of the electrical stimulation. However, a few new results were obtained. In the first place, the patellar or knee reflex, obtained by striking the tendon, was distinctly observed on the body. The contraction was perfectly normal. Another remarkable result was this : the cephalic end of the medulla was stimulated in hopes of exciting the nucleus of the hypoglossal nerve. The attempt was successful, and movements of the tongue such as follow direct stimulation of the nerve were distinctly observed.

Physiologists have not been very sanguine of results from this method of research ; but it seems that its importance has been rather underestimated. It will never be available for original investigations; but it will serve as a means of verifying results otherwise obtained, and makes the inference from the facts with regard to animals to similar conditions in man more reliable.

PARASITISM AMONG MARINE ANIMALS.

IT is a curious fact that nearly all well-defended marine animals are either brilliantly colored or otherwise attractive, as in the case of the sea-anemone, jelly-fish, and tropical shells and crabs. Those with little or no defence are generally inconspicuous, or resemble surrounding objects. This may be explained by supposing that by being inconspicuous they easily escape the notice of their enemies. Brilliant, well-defended animals have little fear of enemies, and by their bright colors attract curious animals within reach of their deadly powers.

Many a fish in the sea instinctively avoids the deadly power hidden behind the brilliantly phosphorescent jelly-fishes. This protective light has saved the jelly-fish much trouble, and is a great aid to it in its struggle for existence among the multitudes of surface animals. Through some curious freak in evolution, an entirely inoffensive cluster of animals, devoid of any protective power, has gained the use of this phosphorescent light, and, by imitating the dangerous jelly-fishes in this respect, sails about the surface, inspiring terror among surface animals that could easily devour them. This cluster of animals is Pyrosoma. In the clusters of floating seaweed in the Gulf Stream there are vast numbers of tiny fishes attired in the color of the floating weed, and that certainly gain protection thereby.

The lump-fish has a sucker on its body by which it can attach itself to some fish of a similar

color, and go freely about, entirely free from danger. This is, no doubt, one way in which parasitism originated. At first an animal attached itself, for protection, to another having the same color; the next step was to burrow into the animal, and extract juices. There is a very curious fish that burrows in the side of another, leaving only a small opening out of which it can project its head and take food. Beyond this it does no harm to the fish. A curious case of parasitism is noticed in Penella, a copepod which burrows into the side of a sword-fish, and has upon its external stem a number of a peculiar species of barnacle, which in its turn has become parasitic.

The sting of the jelly-fish is deadly to nearly every animal of limited size; yet there is a small fish that habitually lives beneath the bell of the jelly-fish, in the midst of flying lasso-cells, without being injured. It manages to pick up a very good living from the crumbs left by the jelly-fish. What benefit it is to its host is hard to understand; but it is usually true, in such cases, that some service is returned. The habit of eating at the same table, or commensalism, is seen in many cases, that of the oyster-crab being a very good example. This crab lives within the oyster without offering harm, although it could easily destroy the oyster; but it is satisfied with what it gets, and leaves its friend alone. That such deadly powers as those possessed by jelly-fishes should have no effect, strange though it may seem, is hardly more wonderful than the power of resisting digestive fluids. In the stomach of a deep-sea sea-anemone a brightly-colored annelid is often found, in the digestive cavity. Whenever the anemone catches a fish, the annelid shares the meal without any injury to the anemone. Unlike intestinal worms, they are never numerous enough to be of any injury to their host.

This habit of one animal being dependent upon another for its existence receives a curious development in the case of deep-sea hermit-crabs and the sandy sea-anemones, of which Epizoanthus is an example. After the free-swimming stage, the anemone settles down upon the back of a shell inhabited by a hermit-crab, and begins to grow around the shell until it has entirely surrounded it, leaving only the entrance clear. The shell is eventually absorbed; and as the hermit grows, the anemone grows to accommodate him, so that he does not have to seek after a new shell. Thus the hermit is furnished with an accommodating, comfortable, and transportable house; but, in return, the hermit transports the sea-anemone from place to place, and keeps it upright. This is a curious case of division of labor among the lower animals.

There is a wide field for the study of the effects of hereditary instinct and evolutionary changes, as exhibited in the cases mentioned. Indeed, it would seem as if the best field for the evolutionist lay among the most degenerate types of an order, viz., parasites; for in their embryonic changes they pass through the higher stages of the past on their way to their present degeneration.

RALPH S. TARR.

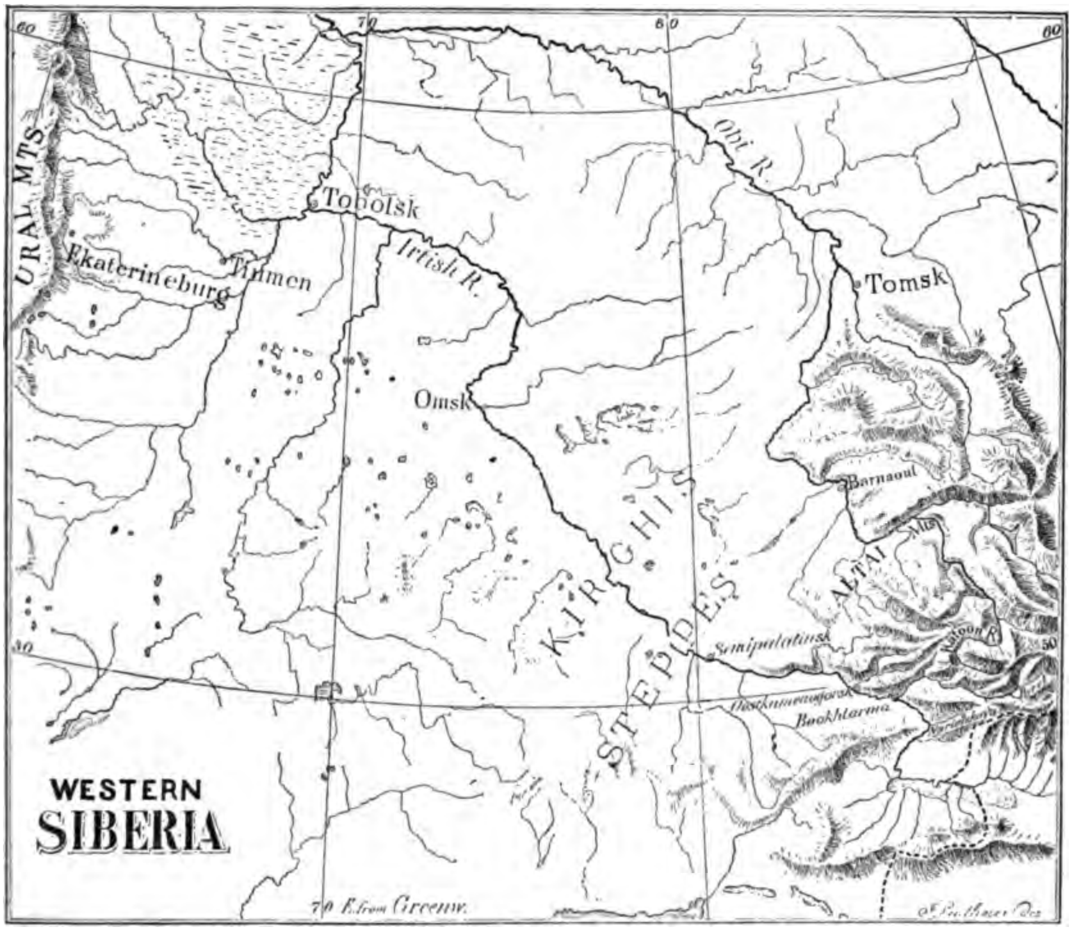
A TRIP TO THE ALTAI MOUNTAINS.

WE left Semipalatinsk on Saturday, July 18, for a trip of about 1,000 versts, or 700 miles, into the wild mountainous region of the Altai. If you will draw a line on the map from the city of Tomsk, in a south by east direction, 600 miles or more, until it strikes the Chinese frontier, you will reach the region which I hoped to explore. The German travellers, Finsch and Brehm, went to the edge of it in 1876, but the high peaks lying farther to the eastward had never been seen by any foreigner, and had been visited by very few Russians. As far as the Cossack outpost known as the Altai Station, there was a post-road. Beyond that point I expected to go on horseback. The road runs from Semipalatinsk up the valley of the Irtish as far as the town of Oostkamenogorsk, and then turns away into the mountains, descending again to the Irtish at the station of Bookhtarma, and finally leaving it altogether at Bolshe-Narimskaya.

For 200 versts after leaving Semipalatinsk, the Irtish is bordered by a great rolling steppe of dry, yellowish grass. Here and there, where this steppe is irrigated by small streams running into the Irtish, it supports a rich vegetation; the little valleys being filled with wild roses, hollyhocks, golden rod, wild currant and gooseberry bushes, and splendid spikes, five or six feet high, of dark ultramarine flowers like larkspur; but generally the steppe is barren and sun-scorched. At Oost-Kamenogorsk and Oolbinsk I made the acquaintance of two very interesting colonies of political exiles, who received me with great friendliness and cordiality.

The farther we went up the Irtish, the hotter became the weather, and the more barren the steppe, until it was easy to imagine one's self in an Arabian or a North African desert. The thermometer ranged day after day from 90° to 103° F. in the shade; the atmosphere was suffocating; every leaf and every blade of grass, as far as the eye could reach, had been absolutely burned dead by the fierce sunshine; bleaching bones of perished horses lay here and there by the roadside; great whirling columns of sand, 100 to 150 feet in height, swept slowly and majestically across the sun-

scorched plain; and we could trace the progress of a single Kirghis horseman five miles away by the cloud of dust which his horse's hoofs raised from the steppe. I suffered constantly and intensely from the heat and thirst, and had to protect myself from the fierce sunshine by swathing my body in four thicknesses of heavy blanket, and putting a big down pillow over my legs. You can perhaps imagine what that sunshine was, when I tell you that I could not hold my bare hand in it without pain, and that wrapping my body in four thicknesses of heavy blanketing gave me at once a sensation of coolness. Tolerably familiar as I was with Siberia, I little thought, when I left Tiumen, that I should find in it a North African desert with whirling sand-columns, and sunshine from which I should have to protect myself with blankets. I almost laughed at a Russian officer in Omsk who told me that the heat in the valley of the Irtish was often so intense as to cause nausea and fainting (sunstroke?), and who advised me not to travel between eleven o'clock in the morning and four in the afternoon, when the day was cloudless and hot. The idea of having a sunstroke in Siberia, and the suggestion not to travel in the middle of the day, seemed to me so preposterous that I could not restrain a smile of half incredulous amusement. Governor Tseklinski, the military governor at Semipalatinsk, subsequently told me that he had seen the thermometer stand



at 130° F. in the valley of the Irtish, with a sand-storm from the south, and that breathing during the prevalence of this simoom-like wind was attended with an almost insupportable sense of suffocation. We saw nothing so bad as that; but at the station of Voroninskaya, in the middle of the arid desert of the upper Irtish, we were overtaken by a furious sand-storm from the south-west with a temperature of 90° F. in the shade in our tarantass. The sand and fine hot dust were car-

ried to a height of a hundred feet, and drifted past us in dense, suffocating clouds, hiding every thing from sight, and making it almost impossible to see or breathe. Although we were riding with the storm, and not against it, I literally gasped for breath for more than two hours; and, when we reached the station of Cherem-shanka, it would have been hard to tell, from an inspection of our faces, whether we were Kirghis or Americans, — black men or white. Such wind, with such suffocating heat and blinding dust, I never in my life experienced before.

At the station at Mala-Krasnoyarskaya we left the Irtish to the right, and saw it no more. Late that afternoon we reached the first outlying ridges of the great mountain-chain of the Altai, and began the long gradual climb to the Cossack outpost known as the Altai Station. Before dark on the following day we were riding through cool, elevated alpine meadows, where the fresh, green grass was intermingled with blue-bells, fragrant spirea, gentians, and delicate fringed pinks, and where the mountain-tops over our heads were white a thousand feet down with freshly fallen snow. The change from the torrid African desert of the Irtish to this superb Siberian Switzerland was so sudden and so extraordinary as to be almost bewildering. At any time, and under any circumstances, the scenery would have seemed to me beautiful, but, after 2,000 versts of unbroken steppe, it made upon me a most profound impression.

We reached the Altai Station about six o'clock in the cool of a beautiful calm midsummer afternoon, and I shall never forget the enthusiastic delight which I felt as I rode up out of a wooded valley, fragrant with wild flowers, past a picturesque cluster of colored Kirghis tents, across two hundred yards of smooth, elevated meadow, into the little settlement of log-houses, and then looked about me at the mountains. Never, I thought, had I seen an alpine picture which could for a moment stand comparison with it. It was unsurpassed in my experience, and, it seemed to me, unsurpassable. I have seen since then the higher and grander peaks farther to the eastward, known as the Bailkee, where the Katoon River springs fully grown out from under enormous glaciers, and rushes away in a furious torrent to the Obi, through the wildest scenery in northern Asia; but I still think, that for varied beauty, picturesqueness, and effectiveness, the mountain landscape which opens before the traveller's eyes as he ascends out of the valley to the Altai Station is unequalled.

The station itself is a mere Cossack outpost of seventy or eighty log-houses standing in rows, with wide clean streets between, and with a quaint wooden church at one end. In front of every house in the settlement is a little enclosure, or front yard, filled with young birches, silver-leaf aspens, and flowering shrubs; and through all of these yards, down each side of every street, runs a tinkling, gurgling stream of clear cold water from the melting snows on the mountains. The whole village, therefore, go where you will, is filled with the murmur of falling water; and how pleasant that sound is, you must travel for a month in the parched, sun-scorched, dust-smothered valley of the Irtish to fully understand.

We remained at the Altai Station three or four days, making excursions into the neighboring mountains, visiting and photographing the Kirghis, and collecting information with regard to the region lying farther east which we proposed to explore. On Monday, July 27, we started for a journey of about 300 versts to the Katoonski Alps, or 'Bailkee,'— the highest peaks of the Russian Altai. Our trip occupied ten days, during three of which we lay in camp storm-bound in the Rakhmanofski valley, nearly 7,000 feet above the sea. The last sixty versts of our journey were made with great difficulty and some peril, our route lying across tremendous mountain-ridges, and deep valleys with almost precipitous sides, into which we descended by following the course of foaming mountain-torrents, or clambering down ancient glacier moraines, over great masses of loose broken rocks, through swamps, jungles of bushes and fallen trees, and down slopes so steep that it was almost impossible to throw one's body far enough back to keep one's balance in the saddle; while one's horse was half the time sliding on all four feet, and dislodging stones, which rolled and bounded for half a mile downward until they were dashed to pieces over tremendous precipices. I was not inexperienced in mountain travel, having ridden on horseback the whole length of the peninsula of Kamchatka, and crossed three times the great range of the Caucasus; but I must confess, that during our descents into the valleys of Rakhmanofski, the Black Berel, the White Berel, and the Katoon, my heart was in my mouth for two hours at a time. On any but Kirghis horses such descents would have been utterly impossible. My horse fell with me once, but I was not hurt. The region through which we passed is a primeval wilderness full of wild game. We saw marals or Siberian elks, wolves, wild sheep, abundant fresh traces of bears, chased wild goats on horseback, and could have shot hundreds of partridges, grouse, ducks, geese, herons, and eagles. The flora of the lower mountain valleys was extremely rich, varied, and luxuriant, comprising beautiful

wild pansies, — purple, yellow, cream-white, and variegated, — fringed pinks, spirea, blue gentians, wild hollyhocks, daisies, forget-me-nots, alpine roses, purple Altai lilies, and scores of flowers that I had never before seen, many of them extremely brilliant, large, and showy. Of plants and fruits, — which with us are domesticated, but which in the Altai grow wild, — I noticed rhubarb, celery, currants (red and black), gooseberries, raspberries, strawberries and blackberries, wild cherries, crab-apples, and wild apricots or peaches. Most of the berries were ripe or nearly so; and the wild currants, in particular, were as large and abundant as in an American garden. The scenery was extremely wild and grand, surpassing at times any thing that I saw in the Caucasus.

On Saturday, Aug. 1, we reached the foot of the last great ridge or watershed which separated us from the main chain of the Katoonski Alps. Sunday morning we climbed about 2,000 feet to the summit of the last ridge, and looked over into the wild valley of the Katoon, out of which rise the 'Katoonski pillars,' the highest peaks of the Russian Altai. I was prepared for something grand in the way of scenery, because I had already seen those peaks two or three times, at distances varying from 25 to 30 miles; but the near view from the heights above the Katoon so far surpassed all my anticipations, that I was simply overawed. It was not beautiful, it was not picturesque: it was overwhelming and stupendous.

The deep, narrow valley or gorge of the Katoon, which lay almost under our feet, was somewhere between 2,000 and 3,000 feet deep. On the other side of it rose far above our heads the wild, mighty chain of the Katoonski Alps, culminating just opposite us in two tremendous snowy peaks, whose height I estimated at 15,000 feet. Colonel Maiyfski, the governor of the district, has since told me that they are believed to be not less than 18,000 feet in height. They were white from base to summit, except where the snow was broken by great black precipices, or pierced by sharp, rocky spines and crags. Down the sides of these peaks, from vast fields of *névé* above, fell enormous glaciers, the largest of them descending from the high saddle between the twin summits in a continuous ice-fall of at least 4,000 feet. The glacier on the extreme right had an almost perpendicular ice-fall of twelve or fifteen hundred feet, and the glacier on the extreme left gave birth to a torrent which tumbled about 800 feet with a hoarse roar into the deep, narrow gorge. The latter glacier was longitudinally subdivided by three moraines, which looked, from our point of view, like long, narrow-shaped dumps of furnace-slag or fine coal-dust, but which, when I afterward climbed up on them, I found to be composed of black rocks from the size of my head to the size of a house, extending four or five miles, with a width of 300 feet, and a height of from 25 to 75 feet above the general level of the glacier. The extreme summits of the two highest peaks were more than half the time hidden in clouds; but that rather added to, than detracted from, the wild grandeur of the scene, by giving mystery to the origin of the enormous glaciers, which at such times seemed to the imagination to be tumbling down from unknown heights in the sky through masses of rolling vapor. All the time there came up to us from the depths of the gorge the hoarse roar of the waterfall, which seemed now and then to be almost lost in the deeper thunder which came from the great glaciers, as masses of ice gave way and settled into new positions in the ice-falls. This thundering of the glaciers continues for nearly a minute at a time, varying in intensity, and resembling occasionally the sound of a distant but heavy and rapid cannonade. No movement of the ice in the falls was perceptible to the eyes from the point at which we stood; but the sullen, rumbling thunder was evidence enough of the mighty force of the agencies which were at work before us.

After looking at the mountains for half an hour, we turned our attention to the valley of the Katoon beneath us, with a view to ascertaining whether it would be possible to get down into it, and reach the foot of the main glacier which gives birth to the Katoon River. Although the descent did look both difficult and dangerous, I was by no means satisfied that it was utterly impracticable. While we were discussing the question, our guide was making a bold and practical attempt to solve it. We could no longer see him from where we stood; but every now and then a stone or small bowlder, dislodged by his horse's feet, would leap into sight three or four hundred feet below us, and go crashing down the mountain-side, clearing two hundred feet at every bound, and finally dashing itself to pieces against the rocks at the bottom with a noise like a distant rattling discharge of musketry. Our guide was evidently making progress. In a few moments he came into sight on a bold rocky buttress about six hundred feet below us, and shouted cheerfully, 'Come on! You could get down here with a telega' (a Russian peasant's cart). Inasmuch as one could hardly look down there without getting dizzy, this was a rather hyperbolical statement of the possibilities of the case.

We finally reached a very steep but grassy slope, like the side of a Titanic embankment, down which we zigzagged with great discomfort, but without much actual danger, to the bottom of the Katoon

valley. As we rode up the gorge toward the great peaks, and finally, leaving our horses, climbed up on the principal glacier, I saw how greatly, from our previous elevated position, I had underestimated distances, heights, and magnitudes. The Katoon River, which from above had looked like a narrow, dirty-white ribbon, that a child could step across, proved to be a torrent thirty or forty feet wide, with a current almost deep and strong enough to sweep away a horse and rider. The main glacier, which I had taken to be about three hundred feet wide, proved to have a width of more than half a mile; and its central moraine, which had looked to me like a strip of black sand thirty feet wide, piled up in form to a height of six or seven feet, like a long furnace dump, proved to be an enormous mass of gigantic rocks three to four miles long, and three hundred to four hundred feet wide, piled up on the glacier in places to heights of seventy-five and eighty feet. In short, it was a tremendous glacier, and yet it was only one of eleven which I counted from the summit of the ridge between the Black and the White Berel. Seven glaciers descend from the two main peaks alone.

We spent all the remainder of the day in sketching, taking photographs, and climbing about the valley and the glaciers, and late in the afternoon returned to our camp in the valley of the White Berel.

Monday we made another excursion to the crest of the Katoonski ridge, and succeeded in getting a good photograph of the two great peaks without a cloud.

We returned to the Altai Station, Wednesday, Aug. 5, and two days later started back for Oost-Kamenogorsk. We were overtaken by a storm in the mountains between Bookhtarma and Alexandrofskaya; lost our way; our tarantass capsized into a hole about nine o'clock at night in the darkness; and we lay there until morning in a cold rain, without shelter, food, or fire. Shortly after daybreak help arrived from the nearest settlement; but it took eight horses and three drivers, two of the latter mounted, to get our tarantass to the next station. GEO. KENNAN.

CURRENTS OF THE NORTH SEA.

THE 79th supplement to *Petermann's mittheilungen* is by Prof. H. Mohn, director of the meteorological institute in Christiania, on 'Die strömungen des europäischen Nordmeeres.' The area thus designated lies between Norway, Novaya Zemlia, Greenland, Iceland, and Scotland, and has been examined by several exploring vessels, especially by Norwegians; so that tolerably full data as to depth, temperature, and salinity, have been determined from surface to bottom. On this basis, Professor Mohn has attempted a new style of investigation of its currents, fed on the south by the warm, dense waters of the North Atlantic; on the north, by the cold, fresher waters from the polar seas. His method is much like that which has been successfully applied to the study of atmospheric currents, and it has led him to very interesting conclusions. First, the density is examined, and the results graphically exhibited on ten sections. Next follow a series of detailed investigations, summarized in six maps, showing, 1°, surface isotherms; 2°, contour lines as determined by hydrostatic equilibrium, the North Sea thus appearing five centimetres higher than the ocean east of Iceland; 3°, the atmospheric pressure for the year, prevailingly low from Iceland towards the North Cape; 4°, the deformation of the surface of wind-formed currents by the deflective force arising from the earth's rotation, which depresses the central area about fifteen decimetres below the marginal; 5°, the same, due to both gravitative and wind currents; and, 6°, the summation of all persistent deforming causes. The currents themselves, as thus deduced, are shown in a larger map; their correspondence with what might be inferred from the isotherms establishes the correctness of the work. Finally, the pressure, temperature, and currents at depths of 500, 1,000, and 1,500 fathoms, are discussed and graphically illustrated in three pairs of maps. Taking this with an earlier monograph (supplement No. 63) by the same author, we have a very full description of the average physical conditions of these northern waters. The methods employed by Mohn may some day be well applied to the American Mediterranean from the Windward Islands around to the Bahamas.

W. M. DAVIS.

THE venerable Professor Vilanova secured the indorsement of the International geological congress, at its last session, to the project of a polyglot dictionary of definitions and technical terms. He himself cannot do more than supply the Spanish-French part of such a work ('Ensayo de diccionario geográfico-geológico,' por D. Juan Vilanova), but he hopes others will take up and supplement his work, until a cyclopaedia of the sciences is produced in which any man can readily find exact statements of the facts in his own language, and their equivalents in all other languages. It is an important work, and the congress and all geologists will doubtless help him to the extent of their power.

SCIENCE.

FRIDAY, JANUARY 8, 1886.

COMMENT AND CRITICISM.

THAT ADDICTION TO THE USE of opium is very much more common than is generally supposed, and that it is on the increase, is shown by a recently published brochure of Dr. Meylert ('Notes on the opium habit,' New York, *Putnam*); and that there is a wide-spread interest in the subject, not confined to the medical profession, is evinced by the fact that this pamphlet has now reached its fourth edition, and that other treatises more pretentious have recently been published, and attained a circulation more or less extensive. Dr. Mèylert attributes many deaths of patients in hospitals and asylums, and of soldiers on the march, to the sudden deprivation of opium to which they have been accustomed; and on this, and the suffering which habitués experience in their efforts to discontinue at once the use of the drug, he makes his plea for the abandonment of the 'rack-and-thumbscrew' treatment, and the adoption in its place of more humane methods. The basis of the author's method of cure is, that the opium habit is not an indulgence to be humored, nor a vice to be punished, but a disease which must be treated as other diseases are, by appropriate remedies. Atropia, which has become a favorite remedy with those who advertise rapid cure, does not stand the tests of experience. Coca and Avena sativa are not of any special value. The bromides of potassium and sodium, quinine, Cannabis indica, strychnia, hydrocyanic acid, chloroform, hyoscyamus, and phosphorus are the remedies in which the greatest reliance is placed; the one or the other, or combinations of them, being prescribed according to the special indication in each case. The moral treatment is not neglected in Dr. Meylert's plan, and the necessity for implicit trust and reliance in the physician by the patient is not overlooked. After all, 'the best test of success is success;' and whether the methods here advocated are adapted to bring about the desired results can only be ascertained by careful and patient study of a long series of cases. We shall watch with interest for these results, which should as soon as obtained be published, whether they speak for or against the methods advocated.

IN A PAPER recently read before the American institute of mining engineers, Mr. A. E. Lehman describes some of the methods of construction and the uses of topographic models or relief-maps. Their use for educational and economic as well as scientific purposes is rapidly increasing, as the belief in the importance of representing quantitatively the vertical element of topography gains strength. The value of the relief-map for all purposes, and especially for educational uses, is seriously impaired by exaggeration of the vertical scale. This should be avoided whenever possible, and in other cases should be reduced to a minimum. While Mr. Lehman advises exaggeration, the appearance of his model of the Cumberland valley, wherein the exaggeration is four and five-sevenths, is a strong argument against it. An even stronger argument is furnished in the form of an ambitious relief-map of the United States, by Mr. F. H. King, and mentioned by Mr. Lehman. In this model the vertical scale is exaggerated over the horizontal sixty-eight and a half times; and the effect, especially in an abrupt mountain region, can be easily imagined. This map has other faults, which will probably limit its sphere of usefulness. Another notable example of the distortion produced by the exaggeration of the vertical scale is the well-known model of the Atlantic and Gulf coasts, made by the U. S. coast and geodetic survey. That effective models can be made, even of extensive areas, without exaggeration of the vertical scale, is abundantly shown by the relief-maps in the national museum.

THE RECENT MEETING of the society of naturalists in Boston was a successful one, as such meetings go. The attendance was fair, considering the eccentric position of the place of meeting, and the papers were in nearly every case of distinct value and interest. But in spite of full attendance at the sessions, and at the dinner that closed the first day of meeting, there was not sufficient acquaintance among the members; and during the sessions the silence of formality settled down

so heavily, that nearly all conversational questioning of the speakers was extinguished. The more experienced in such occasions maintained a certain amount of discussion by well-determined efforts to speak as often as possible; but the greater number felt the difference between speaking and talking, and said nothing. Inasmuch as it is generally agreed that the increase of personal acquaintance, and the pleasure of personal conversation, are the best results brought about by such meetings, we believe it will be worth the while of the naturalists' executive committee to make definite preparation for the accomplishment of these ends at Philadelphia a year hence.

WE HAVE BEFORE US the tenth annual report of President Gilman to the trustees of the Johns Hopkins university. It is a brief but eminently perspicuous and comprehensive document. It is with no little satisfaction that the president marshals in the appendices of his report the swelling lists of professors, associates, lecturers, instructors, fellows, and graduates: and the record of the work done during the year, as given in appendix D, is worthy of the strong force of workers. Perhaps the most notable event in the year was the delivery of a course of twenty lectures by Sir William Thomson of the University of Glasgow. No man living has made to physical science such valuable contributions as Sir William; and his visit and lectures, therefore, were most welcome. The only part of the president's report which seems to call for particular comment is what he terms 'the group system of undergraduate studies.' The discussion refers particularly to the department of undergraduates in the university. With respect to them the president speaks as follows: "In place of a single curriculum, and instead of no curriculum, several parallel curricula have been arranged, which are assumed to be equally honorable, liberal, and difficult, and which therefore lead to the same degree of bachelor of arts. They all include the study of (*a*) language and literature, (*b*) mathematics and other exact sciences, (*c*) historical and moral science; but the proportions of the different studies vary. Seven schedules are announced upon the register, one of which must be chosen by every undergraduate who wishes to proceed to the bachelor's degree. Certain studies are common to all these courses, that is to say, must be taken up by every undergraduate." The seven courses of study are enumerated as the classical, the mathematical-physical, the chemical-biological, the physical-chemical, the Latin-mathematical, the historical-political, and modern languages. No one can question, that, assuming a good entrance preparation, any one of these seven courses may be made the medium of a solid liberal education. This arrangement presents a practical solution of the question of elective studies for college undergraduates. It presents to the young student several lines of study, any one of which may be elected and pursued to the bachelor's degree. It reserves for the university stage of studentship the more free selection of studies which may safely be left to the maturer judgment of those who have reached it.

IN ITS LAST ANNUAL REPORT, the Philadelphia Academy of natural sciences gives a statement of its growth and needs, that, it is hoped, will receive the attention it merits. There is urgent need of more extensive accommodations for the rapidly growing collections, many of which, such as the large series of rocks and fossils of the Pennsylvania geological survey, yet remain unpacked or inaccessible. The present resources of the society are insufficient to meet the rapidly growing demands of modern science. It is earnestly hoped that the contemplated extension of the present building may be realized, that this, one of the oldest, as well as most honored of our scientific societies, may keep pace with the activity elsewhere displayed in American science.

IN CONNECTION with the recent attempts to prevent the further weathering and decay of the obelisk, it will not be without interest to state that Dr. Stelzner of Freiburg early prophesied the injurious effects of our climatic agencies. In his report upon the microscopical characters of the rock, undertaken at the request of Dr. Frazer of Philadelphia, he wrote an earnest plea for the preservation of the obelisk, predicting, that, were no preventive means adopted, it would crumble within a few years. In support of this prediction, he cited the experience with the St. Petersburg obelisk and the press comments on the one in London. This warning, however, owing to the objections of Lieutenant-Commander Gorringe, did not appear in the published report.

On the occasion of introducing his course of lectures at the Sorbonne, M. Ribot reviewed the history and aims of psychology. England, Germany, France, Italy, and the United States, by instituting collegiate and university chairs in this department, and by publishing journals, books, and researches devoted to it, all show an increasing activity in this direction. According to M. Ribot, a psychologist is a naturalist: his subject is a part of biology, and is to be treated by precisely as scientific and as exact methods. It is not a metaphysics in any sense, and is no more called upon to speculate on the nature of the soul than physics to lead us into the essence of matter. It is not a psychology with any religious, moral, or any other tendency, but is a science founded on objective facts, true for all men alike. There are no systems of psychology: there is one psychology, as there is one chemistry.

This psychology, however, was possible only after physiology had been brought to a high state of culture. The physiology of the nervous system, and especially of the brain, is the necessary basis for a scientific study of mind. Psychology also borrows from pathology, because nature prepares experiments which no man would venture to perform. It owes a debt to anthropology, to the social sciences, to culture and history. It takes a broad point of view, having already adopted the methods suggested by comparative biology and the evolutionary movement. The field is already so broad that specialists are necessary, although the whole development is not fifty years old. M. Ribot has given expression to a conviction which is now everywhere current, and which seems destined to play an important *rôle* in the science of the future, in this country as well as elsewhere.

GENERAL ABBOTT'S REPORT ON THE FLOOD ROCK EXPLOSION.

The advance sheets of General Abbott's report to the chief of engineers on the 'Earth-wave at the destruction of Flood Rock' have been kindly sent to *Science*, and form the basis of the following account: —

As to the destruction of the rock itself, 48,537 pounds of dynamite No. 1, and 240,399 pounds of rackarock, equivalent in all to about one hundred and fifty tons of dynamite, were stowed away in the galleries within the rock, and simply a touch on a telegraphic key by little Miss Mary Newton set the whole mass into instant explosion. Photographs taken by three cameras, all exposed before the mass of water lifted by the blast had reached its greatest height, indicate that all parts of the mine were fired at practically the same instant; and, by means of electric recording apparatus, this instant was recorded to be $11^h\ 13^m\ 50^s.2$, eastern standard time. It should have been at eleven o'clock precisely, and readers of *Science* are aware already that observations of the earth-wave were lost at several stations by this delay of nearly fourteen minutes. Concerning this, General Abbott says that if these volunteer observers who have criticised the delay in an unfriendly spirit had known how seriously it endangered the success of the official work intrusted to him, they would doubtless have taken a more charitable view of the matter. It was without question unavoidable, and is much regretted; but, if a similar opportunity ever occur again to make earth-wave experiments on so large a scale, it will be well, on the one hand, for those in charge to give official notice of possible delay when the appointed time is announced, and, on the other, for the detached observers to watch their instruments steadily until a message is sent them that the shock is over.

One of the photographs caught the first sight of the earthquake produced by the explosion. The cameras were eleven hundred and thirty feet from the rock, and the first exposure was made about two-tenths of a second after closing the mine circuit. The view shows that the camera was then still steady; the disturbance had not quite reached it, but was only about one hundred and seventy-five feet away. The second picture was taken four-tenths of a second later, and by this time the more violent portion of the wave had passed. To measure the velocity of progression over greater distances, members of the engineer corps and other officers of the army were stationed at four points on Long Island and at West Point; and, besides the successful observations from these places, General Abbott gives records from Goat Island (the torpedo station at Newport, R. I.), Hamilton and Harvard colleges; and to these we may add Princeton. Accounts of the observations made at the latter two points have already been given in *Science*. At all these stations the observers watched a surface of mercury in which the reflection of some small, well-defined object could be seen. The arrival of the disturbance shook the mercury, and caused the reflected images to disappear. The reports generally agree that the maximum of disturbance was very quickly or immediately reached, and none of them express serious doubt of the accuracy of their determi-

nations. The following table exhibits the results: —

STATION.	Distance in miles.	Interval of transmission.	Velocity in miles per second.
Willet's Point, L.I....	8.33	8.5	0.98
Pearsalls, "	16.78	6 6	2.54
Bay Shore, "	36.65	13.0	2.82
Patchogue, "	48.52	15.4	3.15
Goat Island. R.I.......	144.89	58.8	2.46
Harvard obs'y, Mass..	182.68	219.8	0.83
West Point, N.Y.......	42.34	13.6 10.9 10.9	3.11 3.88 3.88
Hamilton coll., N.Y....	174 37	45.0 45.2	3 88 3.86
Princeton, N.J........	48+	51	0.94

These wave velocities are any thing but accordant, and no satisfactory reason can be given for their variation; but they all agree in showing velocities that are higher than those deduced from observations on natural earthquakes: and from this General Abbott feels confirmed, in his deductions from the explosions of certain torpedoes and at Hallett's Point in 1876, that the more violent the initial shock, the higher is the velocity of transmission. At Flood Rock the charge was about six times as great as at Hallett's Point, and the velocity was from two to three times as great, over essentially the same route. Beyond this, the generalizations are not satisfactory. It is true that the velocities through Long Island, which is largely built of unconsolidated drift, are, on the whole, less than the accordant series up the Hudson valley, through rock; and the Goat Island and Harvard velocities, which must have been almost entirely through rock, seem to show a falling-off in the transmission as the wave weakened over increasing distance. But Hamilton is almost as far as Harvard, and yet its velocity is as great as at West Point; and Princeton must have felt a rock-wave at a moderate distance, and still its velocity had about the rate of that at Willet's Point and Harvard, which are very dissimilarly situated. It certainly cannot be thought that the initial velocity was slower than that at any later moment, except in so far as the nature of material traversed would affect it: therefore the apparent increase along Long Island should be looked for in the less percentage of distance traversed through the drift in reaching the further stations. But beyond this suggestion, hypothesis wanders too freely; and, unless the stations yet to be heard from solve the question, the explosion at Flood Rock has hardly taught us more than that earth-waves are very complicated, and that there is yet much to learn about them.

SUCCESS IN HATCHING THE EGGS OF THE COD.

FOR four seasons experiments have been carried on for the purpose of discovering a practical method of hatching out the eggs of the cod, — one of the most fertile and valuable of the food-fishes found off our coast. During the period mentioned no less than forty forms of apparatus have been devised and operated, with varying success, by different persons connected with the work of the U. S. fish commission. Up to the present time no device has fulfilled the required conditions, even approximately, with such success as the apparatus just devised by H. C. Chester, superintendent of the Wood's Holl station, of the commission.

This apparatus is essentially automatic, and needs so little attention that one man will by its aid readily care for a hundred million eggs. It consists of a trough seven feet six inches in length, two feet in width, and two feet four inches in depth. At about one foot from either end, vertical wooden partitions, extending to within four inches of the bottom of the trough, are secured. This leaves a space about five feet six inches in length between the partitions. In this space six or eight large glass jars are supported upon a frame, with their tops downward. Those used for the purpose at Wood's Holl are ordinary cylindrical, four-gallon specimen jars, with a half-inch hole drilled in the centre of the bottom. The stoppers of the jars are removed, and a single thickness of coarse cheese-cloth is secured over the mouth with strong twine. The jar is then inverted, and lowered into the trough, so that its bottom is about even with the top of the trough. Strips nailed across the top of the trough serve to keep the jars upright.

The accompanying figure, showing the device in

longitudinal vertical section, modified and designed on a somewhat smaller scale than the device now in use, and accommodating only four jars (two in a row), will enable the reader to get a clear conception of the way in which the apparatus is used. The trough *A* is filled with unfiltered sea-water

through the faucet i, the water rising to the level of the line a, before the capacious outlet siphon s begins to operate. This siphon, through which the water runs out of the trough faster than it comes in at i, soon brings the water down to the level of the line b, when the siphon takes in air and ceases to operate, after which the trough again slowly fills up with water to the level of the line a. This process is repeated automatically, and as long as the water is permitted to flow through the device. It requires ten minutes for the water to rise or fall from the one level to the other; and, since the jars have only a cloth tied over the mouth below, the water rises and falls to the same extent in them. This very slow and gentle rise and fall of the water in the jars and trough have been found sufficient to aerate the eggs, and give them all the movement they need.

The majority of the eggs in this contrivance float at the surface. Some, of course, remain suspended below the surface; but an exceedingly small percentage of the eggs ever sink and die, as in almost all of the other forms of apparatus hitherto used. The result is that the mortality is probably under five per cent, — a percentage of loss not greater than that experienced in the most successful treatment of shad ova.

The freshly fertilized ova, treated with an abundance of good milt, are introduced into the hatching-device through the hole in the centre of the bottom of each jar by means of a glass funnel. Beyond an occasional siphoning-off of the sediment on the bottom of the trough and the cloth covers of the jars, the eggs require no attention until hatched.

Heretofore great mortality has been caused by the use of metal in the construction of the hatching-vessels and strainers. Since the adoption of glass, wood, and cloth as the only materials used in the construction of the hatching-apparatus here described, combined with the very gentle movement to which the eggs are subjected, complete success has been attained. The eggs oscillate up and down through a space of only five inches from the level of a to that of b, and, withal, so gently that they suffer no hurtful shocks of any kind whatever. Captain Chester's device will doubtless be used with great advantage in the propagation of the Spanish mackerel. In twenty-four hours the latter would be ready to be set free from the apparatus; whereas it requires eleven or twelve days to hatch the eggs of the cod, with the temperature of the water ranging from 45° to 48° F.

Each of the jars J is seventeen inches high by nine inches in diameter, and will hold from one-half to one million of cod-eggs; so that an apparatus of the style shown above, and occupying not much over a square yard of space, would accommodate from two to four millions of ova, in four jars.

These experiments show that violent movement of the eggs of the cod is of no advantage; that such movement is, on the contrary, injurious, if not mortal, when continuously maintained. The requisite conditions for successful hatching of this important food-fish having been settled, the great station of the fish commission at Wood's Holl affords unlimited opportunities for conducting the work for at least three months of the year, during which time from five hundred to one thousand millions of eggs might readily be hatched out by the aid of the Chester apparatus, and set free in the adjacent waters.

Since my arrival here, I have observed, that, some days after hatching, the larval integument over the head of the embryo cod is raised more and more from the top and sides of the brain. A spacious serous cavity is thus formed over the brain; so that, when the embryo is viewed from the front, it seems as if it bore a sac on the head almost as large as the yelk-bag formerly had been, attached to the top and sides of the head. On account of the fact that the young larvae of the cod seem to delight to remain near the surface, it has occurred to me that this vesicular sinus above the brain is of use in buoying the young embryos up after they have escaped from the egg. That this is actually true, I have every reason to believe from the circumstance that embryos a few days old never rest in the water in a horizontal position, but with the head uppermost, and the tail slanting backward and downward from it at an angle of 45°. When swimming, they move horizontally; but at once, upon coming to rest, the young fish assumes a slanting attitude, the tail dropping down into the inclined position, while the head is thrown up. The large sinus here described was first observed by me, in a less developed condition, on the head of the embryo Spanish mackerel in 1880. The space in this sac in that species I called the supracephalic sinus.

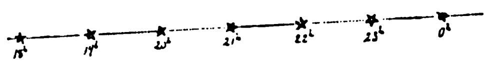
Since the foregoing was written, we have discovered that the specific gravity of the sea-water has a great deal to do with the healthy development of the eggs of the cod. By accident a broken valve admitted some fresh water to our salt-water tank, causing the specific gravity to fall from 1.0256 to 1.021 or 1.022. In this density the eggs immediately sank, causing us to lose over two millions. After this unfortunate experience, and also judging from the fact that ever since the break in the valve has been

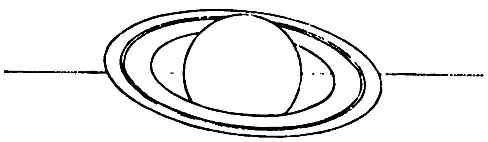
mended no eggs have gone down, we have concluded that it is natural for cod-eggs to float, and that under no other conditions will normal development be accomplished. JOHN A. RYDER.

Wood's Holl, Dec. 21.

CLOSE APPROACH OF SATURN AND μ GEMINORUM.

ON the night of 1886 Jan. 9 (or morning of the 10th, civil time) there will occur a very close approach of the planet Saturn to the star μ Geminorum, whose magnitude is given as 3.22 in the Harvard photometry. The figure below gives the relative configurations of planet and star for successive hours of Greenwich mean time (astronomical) as seen in the ordinary inverting telescope.





To see it as it will appear to the naked eye, with an opera or field glass, or with a telescope having a terrestrial eyepiece, turn the diagram bottom upwards. At the time of nearest approach to the centre of the ball (a little after 21^h) the star will be about 26″ from the centre, or 16″ from the edge of the ball. For convenience the planet is figured as stationary, and the star as moving by it. Of course, the planet (as seen in the telescope) moves to the left, parallel to the line through the successive positions of the star. The dotted line through the planet's centre is parallel to the earth's equator, and makes an angle of 6° 35′ with the major axis of the rings. The time of nearest approach is about five hours after the transit over the meridian of Washington, and is well visible over the whole of this country, though of course best for the Pacific slope, where it will not be so far down in the west. To convert the times given above into the standard civil times, add 7^h, 6^h, 5^h, and 4^h respectively, subtracting 24^h if necessary, which carries it into the civil day of Jan. 10.

Astronomically the event is of very little importance compared with what an actual occultation by the ring, or by the ring and ball, would be. A star as bright as this, and behind the rings, would offer a test we have never had yet of their possible transparency through interstices in the probable cloud of satellites. The action of the dusky ring (not indicated above) would be especially interesting. A central occultation by the ball would give, by means of micrometric measures and the duration of the occultation, a sharp test of the refracting power of Saturn's atmosphere, and the possible semi-transparency of its upper cloud-surface. So near an approach of Saturn to a star as bright as the 3.22 magnitude is an exceedingly rare event. Assuming that the distribution of stars brighter than the 3.22 magnitude along Saturn's path is the same as the average, we find that only once in 612 years will Saturn approach so near one of them as on 1886 Jan. 9. Of course, actual occultations will be still more rare, and only likely to occur by the ring once in about 1,730 years, and by the ball only once in a little over 2,000 years. So near and yet so far from an actual occultation is the coming event.

H. M. PAUL.

THE CONVICT-LABOR PROBLEM.

THE attention of philanthropists and students of social science, which has for a long time past been turned toward this subject, has been increased of late by the attitude of the labor agitators. Perhaps not more than one out of every ten thousand laboring men gives the question of convict-labor competition a thought, but this odd one has during the last decade managed to stir up a great deal of discussion.

That convicts should be employed, and employed, if possible, in a manner profitable to the state, is a proposition that no sane man controverts. Now, there are various ways of employing convicts; and the agitators insist that one of these ways — the one, it so happens, which has in the past produced the largest revenue to the state — has an injurious effect upon the honest laborer by compelling him to submit to an unfair competition. Strange to say, this clamor has had some effect; though how sixty thousand convicts, — the whole number in the United States, according to the last census, — working as they do under peculiarly disadvantageous circumstances, and consisting of the lowest and most ignorant classes of the population, can effect any appreciable competition with the millions of honest and free workingmen, it is difficult to conceive. Those who join in this outcry are to a great extent communists, and leaders of labor organizations, whose sustenance depends upon the amount of agitation they can create, together with such political aspirants as aid them for purely selfish purposes.

The effect of all these elements combined has been visible in the statute-books of several states. Among these is New Jersey, whose legislature

passed a law, Feb. 21, 1884, abolishing the system of contracting for the labor of prisoners at so much per day, and followed it up with a law, dated April 18 of the same year, directing the introduction of the 'public-account' or 'piece-price' plan, as the prison authorities should decide. The contract system, it was claimed, was the source of the unfair competition complained of, and these laws were passed under the agitators' influence expressly to prevent such competition.

The new law took effect on the expiration of the old contracts, in July, 1885, and in the reports of the prison officials for the current year we have a summary of the results obtained thus far; and, inasmuch as several states are having the same experience as New Jersey, the conclusions reached by her officials in this matter are of general political as well as scientific interest.

The 'public-account' plan was so generally discredited, that the officials adopted the other alternative under the law; namely, the 'piece-price' plan. Under this system, the contractor pays a fixed price per dozen, gross, or thousand for work done on materials furnished by him. The introduction of this radically new system occasioned some delay for the purchase of machinery, fitting-up of shops, etc., and the authorities are cautious enough to state that their experience of the new system has been too limited to admit of unqualified indorsement or condemnation. Nevertheless, all the facts and figures presented in these reports point in the same direction. They prove that not only does the state treasury lose largely by the change from the old contract system, but that the contractors are enabled to put their goods on the market at a less cost for manufacturing than ever before; so that, as far as there is any competition with free labor, it is greater under the 'piece-price' plan than it was before. This is a result which reflects upon the sagacity of the agitators themselves; for, if their pet system can be proved injurious on so short a trial, their stock in trade is exhausted.

One contractor who under the former system paid fifty cents per day for the labor of every convict, skilful or unskilful, who went into his shops, now averages less than half that sum per convict. In one or two cases the contractors now pay a few more cents per day's labor than formerly, but this apparent gain results from greatly increasing the quantity of the work; so that, even with an apparently similar financial result to the state, the product is manufactured cheaper now than under the contract system.

These early conclusions from this new departure are interesting. They show that the labor agitators are many, and the mass of political scientists and humanitarians are right in upholding the contract system as the best and most profitable for the employment of convict-labor. Reasonable limitations to the operation of the contract system may very possibly be suggested by experience; but these data from New Jersey ought to insure the rejection of the 'piece-price' plan everywhere, or else some radical modifications in its details.

NICHOLAS MURRAY BUTLER.

NOTES AND NEWS.

THERE is not much to be said of the popular-science articles in the December magazines, for there are not many of them; and what there are, are very popular, though quite interesting. The *Atlantic* adds another to the already long list of reviews on the recent 'Life of Agassiz,' but fails to say, what seems tolerably obvious, that the time has not yet come when the value of Agassiz's scientific labors, or indeed of his influence on the progress of natural history in the United States, can be correctly estimated. John Burrows, in the *Century*, gives, in very readable form, some notes on bird enemies, — jays, owls, vermin, mice, snakes, and 'collectors.' In *Harpers' magazine* there is a highly aesthetic article called 'A winter walk.' It is beautifully illustrated, and well adapted to the wants of ladies of scientific turn of mind. Perhaps the author tried to imitate Thoreau; but if he did, he failed. To persons interested in ornithology, Mr. Edward C. Bruce's article in *Lippincott's magazine*, on 'Birds of a Texan winter,' will doubtless be entertaining. After mentioning a few of our birds that do not migrate, Mr. Bruce goes on to tell us of the northern birds he has seen in Texas during the winter, — plovers, herons, wild geese, etc. The English magazines have even less than the American on natural science this month. There are only two articles to be mentioned. One is by Benjamin Kidd, in *Longman's magazine*, on the 'Humble-bee,' and gives some description of the habits of this insect, based, it would seem, largely on the author's personal observation. The other is by W. Mattieu Williams, in the *Gentleman's magazine*, and is called 'Science notes.' The topics dealt with are, the origin of boracic acid, meteoric explosions, magnetic sifting of meteorites, fireproof paper structures, the future of the negro, the sleep of fishes, and icebergs and climate.

— The dog by which Kaufmann, who is now in Paris for treatment under Pasteur, was bitten, is shown conclusively to have been mad, a dog bitten by it nearly at the same time having since died of unmistakable rabies.

— Prof. Edward Süss delivered in the Geo-

logical institute of Vienna, on Nov. 3, a lecture on the means of preventing explosions in coal-mines. Experiments have been made in the Karwin colliery in order to obtain, if possible, positive results, and these experiments are still being continued. It has been demonstrated that whenever the barometer falls, the quality and intensity of explosive gases increase. The Austrian government has directed that the weather-charts published shall be provided by all the managers of coal-mines in that kingdom, and at Karwin a regulation is in force to the effect that at the approach of a barometric depression all work is to cease in dangerous places.

— The 'Report on the geology of Marion county, Kentucky,' recently published, is in many respects a curiosity. The history, topography, and drainage, treated of in five pages, is followed by the geology in fourteen pages, archeology in five pages, and a list of fossils and notes on Beatricea in eleven pages. The following selection will illustrate the style of the report: "The soil from the disintegration of the Crab orchard shale is quite poor, and responds very slowly to the toils of the farmer; while the forest growth is very much dwarfed, although similar in species to that of the tall, well-shaped, large-sized timber-trees of the epoch before it. The forests originally were well timbered" (p. 17). This last sentence is particularly remarkable.

— Most of the rivers of New South Wales fall into the sea through sandy estuaries obstructed by extensive bars. The removal of these bars, or rather the formation of practicable channels through them, is of great importance to the development and trade of the colony. A paper on this subject was read before the Royal society of New South Wales in June, 1884, by Mr. Walter Shellsbear. The formation of bars at the mouths of rivers is stated by the author to be mainly due to the action of waves in lifting large quantities of sand as they pass into shallow water. The sand is carried up the estuary by the incoming tide, and deposited when beyond the action of the waves. The ebb-tide, being unassisted by the waves, is unable to remove the sand, and hence the tendency is to close the entrance. While strong freshets may for a time sweep a portion of the obstruction away, the frequent occurrence of long droughts in New South Wales leaves the river-mouths in a very bad state. The author advocates the use of break-waters, jetties, and training dikes, more or less parallel, and running out into deep water, three and a half fathoms or more, — a depth beyond which the waves are stated to have no appreciable effect on the bottom.

LONDON LETTER.

ONE of the matters which grew out of the education conference at the International health exhibition in London in August, 1885, some account of which appeared in the columns of *Science*, was the proposal for the establishment of a teaching university for London. The present University of London is mainly an examining board. In the case of its medical degrees, attendance upon specified courses of instruction in one or other of the medical schools recognized by the university is compulsory. The degrees in arts, science, etc., may be obtained by any persons, of either sex, who can satisfy the examiners as to their attainments, no matter whether that knowledge has been acquired by private study, private tuition, or college attendance. In point of mere attainment, the London degrees rank higher than the corresponding degrees of any other university; but they do not imply, as those of Oxford, Cambridge, etc., do, that their holder has been taught in colleges by men of university rank and standing, and according to university methods. The scheme of examinations laid down by the senate of the University of London naturally exercises a very wide influence upon the subjects taught in schools and colleges all over England; since more than two thousand candidates annually enter for the matriculation, or entrance examination, of the university. As there is no official connection between the senate and examiners on the one hand, and the principal professors and teachers on the other, the latter (some of whom are men of the greatest eminence and of world-wide fame) naturally feel aggrieved at the dominant influence which the university exercises over their courses of instruction, since they are practically compelled to teach those subjects prescribed for examination, and almost those alone. Moreover, there is a growing feeling that the enormously wealthy guilds and companies of the ancient city of London will be shortly compelled, either by actual legislation or by the potent force of public opinion, to appropriate more of their funds than they at present do, to educational purposes. These were the two main ideas which led to the formation of the Association for the promotion of a teaching university for London. On this body are representatives of all the principal educational institutions of London, in the four great faculties of arts, science, laws, and medicine. Large bodies take time to move, and, where there is much diversity of opinion, it is very difficult to formulate a scheme which shall meet with the acceptance even of a bare majority. This desirable stage has not yet been attained. The members of the existing university of London, however, naturally had to con-

sider what should be their attitude towards the new body. Accordingly, at a very full meeting of convocation (as the general body of graduates above a certain standing is termed) last summer, the whole subject was referred to a special committee of forty (of which the present writer was a member), to consider and report. This committee appointed Lord Justice Fry its chairman, and a scheme was by it prepared for the re-organization of the existing university from the points of view of the new association, — a task the more easy, as several gentlemen were members of both bodies. At an adjourned meeting of 'convocation' held on Dec. 8, this scheme was rejected, and, as the former committee refused to act, another committee of twenty-five was appointed to modify it in the sense indicated by convocation.

The year which is now drawing to a close has been marked by greater losses to English biology than any since 1882, which witnessed the deaths of Mr. Darwin, Prof. Francis Balfour, and Sir Wyville Thomson. Prof. Morrison Watson was a well-known anatomist of hardly more than middle age; while Drs. W. B. Carpenter, J. Gwyn Jeffreys, and T. Davidson were almost the last of that older school of zoölogists who are too often looked down upon by the younger generation which has been trained to minute histological work. Dr. Davidson had the happiness of completing the work to which he had devoted the labors of a long life; but his two old friends have left much material behind them, the working-out of which must be completed by other hands. Dr. Carpenter's loss will be severely felt by those who believe in the organic nature of eozoon. He had accumulated a very great amount of material, which was regarded by all to whom he had shown it as proving his case in the most satisfactory manner possible.

An important reform has just been carried out at Oxford. Honor candidates in law, history, and science, will henceforth be excused from the classical examination at the end of their first, or the beginning of their second, year, which is known as 'moderations.' The preliminary examination 'responsions' can be passed before residence begins, either in the leaving examination of a public school or at the university itself; and men can therefore specialize during the whole of their university course, instead of having their attention distracted from physics, chemistry, or biology by the necessity of getting through 'mods.' This has long been the case at Cambridge, and is one of the reasons for the overflowing state of its medical school.

The old public schools are also beginning formally to recognize that there are other branches of education besides the classics. Rugby is about to institute a modern side; and changes in the same direction are being gradually introduced at Eton, her great rival, Harrow having long had something of the kind. The committee of the city and guilds of London institute for the advancement of technical education have offered free studentships of the annual value of thirty pounds, tenable for three years at the central institution, to be awarded by the head master of each of the principal public schools. It will be a matter of some interest to see what proportion of boys will avail themselves of these opportunities for obtaining the higher technical education.

W.

London, Dec. 17.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The moon's atmosphere.

MY friend, Professor Langley of Allegheny, has recommended to me to give you an account of a phenomenon twice observed by me on the occasion of two occultations of Jupiter. At the moment of contact, the planet, instead of passing behind the moon, appeared to be projected upon the moon's edge, until nearly or quite one-half of the disk of the planet was visible on the moon's surface. Then suddenly the whole planet disappeared behind the moon. As this phenomenon must be due to refraction, it would indicate a lunar atmosphere. The instrument with which I observed the occultation was a telescope made for me by Alvan Clark, with a four-and-a-half inch aperture.

JAMES FREEMAN CLARKE.

Jamaica Plain, Mass., Dec. 31.

Demand for good maps.

Your comments in the number for Dec. 18, on the character of our small maps, are to me very welcome, and I hope you will follow the subject up till some decided impression is made on the minds of the publishers. The maps in our school geographies are, to me as a teacher, a constant source of vexation. Indistinct, incomplete, inaccurate, they baffle attempts at close work, and so compel, if solely depended upon, a very elementary grade of work. The small *schul-atlas* that a German boy buys for twenty-five cents is worth ten times as much as our best geography maps.

You spoke of old plates. I have seen within two years a wall-map of North America in which the Yukon River had not been drawn. Said map was shown as a sample in the office of one of our largest publishing-houses.

When the German publishers bring out their work so perfect, it seems as if the material was provided for American geography-makers. Is the reason they do not use it because, with German lettering, the maps cannot be reproduced by the photographic process and be available? Or are they afraid of repeating the mistake of one of our atlas-makers, who produced a town in Africa called Elfenbein?

However it may be, we do need better school-maps.

They should be maps in which the various features of surface are clearly, carefully, and fully drawn. I do not mean maps full of names, but full of features. To illustrate: Where are the Alps? The Alps are in Switzerland; and the schoolboy finds on his map 'Alps' printed on the south side of that portion labelled 'Switzerland.' A good map would show at least four ranges there; and proper maps of Austria, Italy, and France, would teach him that 'Alps' is a generic term with at least thirteen applications in southern Europe.

Norway and Sweden appear on most school-maps with but one or two rivers, because, I suppose, there is no long and large stream there important enough to have its name memorized; but what an idea does such a map give of that country? I can count over sixty rivers there on a map in Andree; and enough of them should be drawn, even if without naming, to show the true character of the surface.

Similar instances could be given by the dozen. But I want to take up another point. When are we to see a geography with an index? Studying geography by the topical method, an index is well-nigh indispensable. By any method, twice as effective work can be done if the material can be viewed from the stand-point of the kind of feature, production, occupation, or race, as well as in relation to this or that political subdivision.

I do not think it too much to insist on, that every ocean, sea, gulf, bay, strait, channel, lake, sound, harbor, canal, river, waterfall, bight, firth, bayou, roadstead, etc.; every land feature, every product, occupation, language, religion, form of government, town and political division, — in short, every thing namable that has been mentioned in the text or appeared by name in the maps, — should be indexed by page or section, and, in case of map features, with latitude and longitude.

Why, even in Morden's 'Geography rectified,' published in 1693, there is a copious index, not to mention later works (1809, 1831) likewise favored.

With an index to aid him, a scholar can classify, compare, and infer; and the value of the text-book would be doubled.

Nor would it be difficult to mention other ways in which our geographies could be improved. But if we can first have some better maps and an index worthy the name, we shall have gained much. I hope you will not be content with a few leaders. The matter is one of no slight importance. Perhaps, if our publishers read Prince Kropotkin's article in the December number of the *Nineteenth century*, they would be inspired to do better. Let us hope they will.

C. H. LEETE.

New York, Dec. 31.

The temperature of the moon.

Mr. Langley does not seem to have examined my condition for determining the moon's temperature with sufficient care. It is true that in the equation a moon of maximum radiating power was assumed; but it had been first shown that the temperature of such a moon must be the same as that of any other, provided the relative radiating and absorbing powers are the same, as is usually assumed. The equation is between the absolute rate of radiation and absorption of heat, in which r, the relative radiating power, enters as a factor on the one side, and a, the relative absorbing power, on the other. If these are equal, of course they can be omitted, which is the same as using unity as the relative radiating and absorbing powers, and so the same as assuming that the moon has a maximum relative radiating and absorbing power. The relative radiating and absorbing powers, and the proportion of heat reflected, do not, therefore, come into the condition at all. It cannot be said with propriety that the moon loses heat by reflection, as stated by Mr. Langley; for the reflected heat has not been appropriated by absorption, and therefore cannot be said to be the moon's heat. It has come to the moon's surface and been rejected, and it has nothing to do with its temperature. The condition which determines the static temperature is, that the rate with which heat is radiated must be exactly equal to that with which it is absorbed. When this is the case, there can be neither increase nor decrease of temperature.

But perhaps this matter will be more readily comprehended by looking at it in a less mathematical way. We have a moon, say, with a surface of maximum relative radiating and absorbing power, and with a temperature below the static temperature corresponding to the rate with which it is receiving heat. With this temperature, the absolute rate with which the moon radiates heat is less than that with which it is receiving and absorbing it, and the difference goes toward raising the temperature of the body. But as the temperature increases, and with it the rate of radiating heat, though not proportionally, it after a time rises to that temperature at which the rate with which heat is radiated from the moon is exactly equal to that with which it is received and absorbed by it, and its temperature then remains stationary. This, expressed in a mathematical form, is the equation of condition.

But now suppose that the moon's surface is such that it radiates and absorbs heat at only half, or any other proportion, of the rate that one of maximum relative radiating and absorbing power does. Our condition is still satisfied; for although the moon's surface now is radiating heat at a rate which is only half, or any other assumed proportion, of what it was before, it is also absorbing at only the same rate, whatever it may be, and there is no change of temperature needed to satisfy the condition of static temperature. Hence, so far as the static temperature of the moon is concerned, it is no matter what part of the heat received is absorbed, and what reflected; these being complementary to each other, and both together equal to the heat radiated by a moon of maximum relative radiating power, under the condition of a static temperature. Of course, our condition for determining the temperature is not applicable where there is a rapid increase or decrease of temperature.

WM. FERREL.

Washington, Jan. 4.

Yankee.

In a paper upon the origin of 'Yankee Doodle,' read lately before the New York historical society, Mr. George H. Moore states that the word 'Yankee' is pure Dutch. 'Yankin,' he says, in the vocabulary of the early New York Dutch, meant 'to grumble, snarl, or yelp,' and its derivative noun meant 'a howling cur.'

But where did the New York Dutch get the word? I think from the Indians. Peter Martyr says that Sebastian Cabot named the coasts of Newfoundland and thereabouts the land of baccalaos, because in the seas he found a multitude of large fish which

the natives called by that name. This word 'baccalaos' was used by the Basque fishermen, and meant 'codfish;' and, if the natives used it, it was only after they had learned it from the Basques.

Sailors are proverbially profane, and most likely these sailors of the olden time made use of the name of the Deity, much as sailors do at the present day. The Basque name for God is 'Yainkoa,' and no doubt it was frequently used by the fishermen: so frequently, indeed, that the Indians called the strangers by it, just as the little urchins of Havre and Dieppe now call the English tourists 'Meestaire Goddam.'

The Indians employed the term to indicate a foreigner, and from them the early colonists learned it. It may afterwards have passed into a word or term of contempt, but it had its origin in the attempt of the Indians to pronounce the Basque word 'Yainkoa.'

TH. E. SLEVIN.

San Francisco, Dec. 25.

'Chinook winds.'

In an article by Mr. Ernest Ingersoll, on the Canadian Plains, in the last number of *Science*, the so-called Chinook winds of that portion of these plains adjacent to the base of the Rocky Mountains, are described as warm, dry winds 'sweeping up from the great Utah and Columbia basins.' In a previous number of *Science* (iv. 166) Mr. Lester F. Ward, in speaking of similar winds in the upper Missouri and Yellowstone valleys, says, "It is also a matter of record that the temperature on this latitude diminishes toward the east, and that colder weather prevails in Minnesota than in Dakota, and in Dakota than in Montana. The people attribute this to the occurrence of what they denominate 'Chinook winds;' i.e., winds laden with moisture, and moderated in temperature from the warmer regions of the Pacific slope." By the inhabitants of the region in which these winds occur, they are very generally explained as currents of air coming from the warm surface of the Pacific Ocean, and flowing eastward through the low passes in the mountains.

Having had occasion to note the character and effect of these peculiar winds while engaged in geological and exploratory work in the western part of the plains and in the mountains at different times during the last ten years, I may be pardoned for stating my belief that the above theories are unsatisfactory, and based on hasty or imperfect consideration of the facts.

As experienced, the Chinook is a strong westerly wind, becoming at times almost a gale, which blows from the direction of the mountains out across the adjacent plains. It is extremely dry, and, as compared with the general winter temperature, warm. Such winds occur at irregular intervals during the winter, and are also not infrequent in the summer, but, being cool as compared with the average summer temperature, are in consequence then not commonly recognized by the same name. When the ground is covered with snow, the effect of the winds in its removal is marvellous, as, owing to the extremely desiccated condition of the air, the snow may be said to vanish rather than to melt, the moisture being licked up as fast as it is produced.

Winter winds of this character occur over a tract of country stretching at least as far north as the Peace River (north latitude 56°), and at least as far south as northern Montana,—a distance of about six hundred miles. In the corresponding portion of its length, the Cordillera belt is comparatively strict and narrow, the western edge of the plains being separated from the ocean by about four hundred miles only of mountainous country. In this circumstance, taken in connection with the moisture-laden character of the air along the northern part of the west coast, we find a clew to the correct explanation of the remarkable characteristics of the so-called Chinook wind. It is in effect, I conceive, precisely similar to that of the *foehn* of the Alps, and is due to the great amount of heat rendered latent when moisture is evaporated or air expanded in volume, but which becomes again sensible on condensation of moisture or compression of the air.

To meteorologists the phenomenon requires no further elucidation; but as it is one which attracts much attention in the west, owing to its important effect in removing the snow from the grazing-lands, the following more detailed notice, written by me with special reference to the Peace River country, may be of interest (quoted, with little alteration, from the Report of progress, geological survey of Canada, 1879–80, p. 77 B.): —

"The pressure in the upper regions of the atmosphere being so much less than in the lower, a body of air rising from the sea-level to the summit of a mountain-range must expand; and this, implying molecular work, results in an absorption of heat and consequent cooling. The amount of this cooling has been estimated as about one degree centigrade for a hundred metres of ascent when the air is dry, but becomes reduced to half a degree when the temperature has fallen to the dew-point of the atmosphere, and precipitation of moisture as cloud, rain, or snow begins; the heat resulting from this condensation retarding to a certain degree the cooling due to the expansion of the air. When the air descends again on the farther side of the mountain-range, its condensation leads to an increase of sensible heat equal to one degree centigrade for each hundred metres.[1] It is owing to this circumstance that places in the south of Greenland, on the west coast, during the prevalence of south-easterly winds, which blow over the high interior of the country, have been found, in winter, to experience a temperature higher than that of north Italy or the south of France, though the North Atlantic Ocean, from which the winds come, can at this season be little above the freezing-point. The wind well known in the Alps as the *foehn* is another example of the same phenomenon. It is thus easy to understand how the western plains may be flooded with dry air, but much inferior in temperature to that of the coast, notwithstanding the intervening mountain-barrier.

The data are yet wanting for an accurate investigation of the circumstances of our west coast in this regard, but a general idea of the fact may be gained. We may assume that the air at the sea-level is practically saturated with moisture, or already at its dew-point; that in crossing the mountainous region the average height to which the air is carried is about 2,000 metres (6,560 feet), and that it descends to a level of about 700 metres (2,296 feet) in the Peace River country. The loss of sensible heat on elevation would in this case amount to 10° C. (18° F.); the

[1] The figures are Dr. Hann's, quoted by Hoffmeyer in the Danish geographical society's journal, and reproduced in *Nature*, August, 1877.

gain on descent to the level of 700 metres, to 13°C. (23°.4 F.). The amount of heat lost by the air during its passage across the mountainous region by radiation, and contact with the snowy peaks, cannot be determined. It is, of course, much greater in winter than in summer, and depends also on the speed with which the current of air travels.

Owing to the width of the mountain-barrier, the main result is complicated by local details; regions of considerable precipitation occurring on the western slopes of each important mountain-range, with subsidiary drier regions in the lea. The last of these regions of precipitation is that of the Rocky Mountain range properly so called, in descending from which a further addition of heat is made to the air, which then flows down as a dry and warm current to the east. GEORGE M. DAWSON.

Ottawa, Canada, Dec. 31.

The Taconic controversy in a nutshell.

The New York geologists encountered a great group of metamorphic, apparently successive and conformable strata, extending from the Hudson River eastward into New England (1836–42).

Emmons claimed they were all older than the Potsdam, and named them all Taconic. His colleagues of the New York survey, and their friends of the Canadian survey, regarded them all later than the Potsdam, and applied to them the terms of the New York system up to the Medina (1842).

Fossils were discovered in some of the eastern belts of this metamorphic series, and announced by Hall and others in 1842, rather indicating the whole series was post-Potsdam.

Emmons re-examined the whole, and called attention to an unconformable overlying of the Hudson River and calciferous upon the older slates of the true Taconic, and distinctly re-asserted the pre-Potsdam age of the Taconic system, from which he figured primordial fossils (1844). He was supported by Billings and Barrande, and by Colonel Jewett of Albany, but as time passed he was ostracized from geological circles.

The authority of Barrande, however, was sufficient to convince the opponents of Emmons on the New York and Canadian surveys, and they expressed a willingness to abandon the use of the conflicting term, 'Hudson River group' (1862).

The Canadian geologists, however, fertile in the invention of devices of stratigraphic nomenclature, renewed the contest by two flank movements, — one the Huronian phalanx, aimed at the lower strata; and the other, the 'Quebec coffin,' aimed at the overlying strata, thus rallying the whole discomfited cohort (1855–61). Emmons died in the midst of this movement.

As time passed, the term 'Hudson River group,' besmirched and hesitating, was re-habilitated by being shifted to new ground, — that of the Lorraine shales (1877).

In Wales, Barrande had discovered the 'primordial zone' in Sedgwick's 'Cambrian;' but, as the Sedgwickian term was then under as strong a ban in England as 'Taconic' was in America, Barrande's term was adopted in England, and also transferred to the equivalent strata in America.

Gradually, in other places outside the Hudson valley, the primordial fauna came to light, the strata taking other Canadian names, — St. John's and Acadian; these terms becoming current in the United States.

Finally the existence and fossiliferous character of a great series of strata, occupying exactly the position, claimed by Emmons, and mapped by him under the term 'Taconic,' lying below the Potsdam sandstone, has been demonstrated, and is admitted by all geologists.

The term 'Quebec' not being approved, and 'Huronian' seeming to collide, the later English term, 'Cambrian,' is applied in America to this very horizon to which Emmons had given the name 'Taconic.'

Some of the opponents of Emmons, re-enforced lately by active, younger men, revive the fossiliferous character of some of the eastern belts as new matter, adding many interesting and valuable details, and begin again to fire at the old fort, long ago abandoned by Emmons, insisting that Emmons is still intrenched there (1872–85).

It seems to me that any fair minded geologist, finding primordial fossils in the strata mapped by Emmons as Taconic, lying below the Potsdam, would at once admit the strata to be Taconic; just the same as, if he found non-Taconic fossils in an area not claimed as Taconic, except by a mistake in a preliminary definition (corrected by its author), he would at once admit those strata were not in the Taconic, and were not intended to be so described.

The same mistake was made by Emmons at first as by his opponents. None of them imagined they had to deal with two different and unconformable formations. The strata were all either Taconic or Hudson River. Emmons approached them from one side, the primordial, and his opponents from the opposite direction. Each had evidence to support his claim; and, viewed from his own stand-point, each was right. It is unfair to Emmons, and to American geology, to insist that this preliminary mistake should consign to oblivion the great fact that in America, and by an American geologist, was first discovered the primordial zone of geology.

If the Taconic is to 'lose its identity' because a portion of the original described strata prove to be post-Potsdam, what shall become of the Hudson River, by the same reasoning, if it be treated with honesty, when nearly all the strata covered originally by it prove to be pre-Potsdam? If the strata can fairly be divided between the conflicting claims, as the structural geology of the region seems to require, it would be for the honor of American geology to so divide them. It seems, however, that the extreme anti-Emmons partisans will not grant such a division, but insist on the utter destruction of every thing that smacks of Taconic. N. H. WINCHELL.

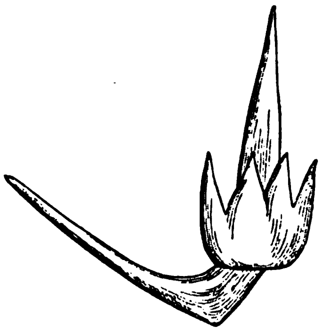
Relics from an Indian grave.

On the Conejo plateau in Ventura county, Cal., and about fifteen miles from the coast, a conical hill rises to the height of a hundred feet, with a base of several hundred feet. On the south side of this elevation, and stretching more than half around it, is the remains of an old Indian town. At the top of the hill is a circular depression, indicating the spot where once stood the 'sweat,' or council-house, of the tribe that occupied this site. Near the centre of the crescent-shaped village is the place where the dead were buried. Early last month the writer examined this burial place, which yielded about a hundred and

fifty skeletons deposited from one to five feet below the surface. The usual method of sepulture practised by the Santa Barbara stock of Indians prevailed here; namely, the knees were drawn up against the breast, and the corpse was buried face downward.

With the skeletons were found three ollas carved from crystallized talc, which were used for cooking-purposes; two large sandstone mortars, finely finished, used for triturating grain and acorns; a sandstone bowl about one inch deep and six inches in diameter; two conical pipes and several large beads of serpentine; several sheets of mica with hole drilled at the side; a broken tortilla stone; several balls of paint; and thousands of shell and glass beads, wampum, ornaments, etc. In a Haliotis shell (H. splendens) I found eight old fashioned flat brass buttons, with numerous specimens of wampum, manufactured from Olivella biplicata. The remains of a metal knife were discovered, which, with glass beads, buttons, and a portion of an old-fashioned water-bottle, shows that this place was inhabited since the advent of the white man, or within the past three hundred and forty-three years.

Probably the most interesting relic discovered was a metal fish-hook. It has a shank about four and a



half centimetres in length, with a point about three and a half centimetres long, which, from its shape, I should judge was of Indian manufacture. An Olivella shell was scalloped or notched, leaving it somewhat in the shape of a crown. The base was perforated, and the shank of the hook pushed through it. This was doubtless intended as an attraction to the fish. The species is Olivella biplicata, some of which are very white, and, at the end of a line, would be nearly or quite equal in brilliancy to the pearl oyster-shell used by the South-Sea Islanders for the same purpose. By the kindness of the publisher of *Science*, an engraving of the fish-hook is presented. It is in a somewhat restored form, the original being corroded to some extent by rust.

STEPHEN BOWERS.

San Buenaventura, Dec. 8.

New find of fossil diatoms.

Seeing a reference to diatoms occurring in clay strata in a railroad-cutting near Philadelphia, in two of the recent issues of *Science*, I wrote to Dr. Koenig, the discoverer, for a sample of the diatom-bearing clay. I received the clay promptly, and am delighted to be able to say, that, after a five-minutes' preparation, I had the pleasure of noting a very rich slide containing at least thirty species of diatoms; the forms corresponding chiefly to the recent fresh-water forms, but characteristically different, as relates to the association of the species, when compared with the forms occurring in the sub-peat deposits of the eastern United States.

My reason for making this communication is, that the value, interest, and importance of this new find of diatomaceous material has not been sufficiently emphasized in the two articles in *Science*, and might be overlooked by diatomists, and all who are on the constant lookout for new localities of fossil diatoms.

K. M. CUNNINGHAM.

Amoeboid movement of the cell-nucleus.

The study of the cell-nucleus has become a subject of such absorbing interest in biology, that we feel justified in asking a little of your space to make known what seems to us a promising field for investigation. During the last year, in studying the blood of Necturus, after its removal from the body and in the blood-vessels, we were struck with the great size and distinctness of the nucleus of the white corpuscles. But what seems especially interesting and important is the fact that the nucleus of the white blood-corpuscles exhibits a very marked amoeboid movement, both in the vessels of a curarized animal and on the microscopic slide. These movements are as vigorous and easily followed as are those of the cell-body; and often both the cell-body and nucleus are undergoing amoeboid movement at the same time, the movements of the cell-body and nucleus seeming to be entirely independent of each other. From the ease with which the white corpuscles are obtained and observed, from the size and activity of the nucleus and its distinctness in the living condition, it is confidently expected that the study of the white blood-corpuscle of Necturus will greatly assist in making more definite our knowledge of the nucleus, its so-called membrane, and the processes of its division.

S. H. and S. P. GAGE.

Anat. lab. Cornell univ., Dec. 25.

English sparrows.

In *Science*, Dec. 18, appeared some remarks on the English sparrows that do not at all agree with our experience here. We have many orchards and groves in and around our village. Many of us have provided boxes for wrens, martins, bluebirds, etc. Robins, cardinals, crimson-breasted grossbeaks, cat-birds, etc., are innumerable around us. A few years ago some of our people, accustomed to watch the many kinds of birds that frequent our court house grove, asked me about 'a little bird that had just newly appeared in the grove.' They said that it was "driving all the other birds away. Not content with merely fighting and mastery, it drove the others clear out of the town." The people had been watching them for some days, and reported that half a dozen birds had actually made themselves the sole possessors of our melodious grove, heretofore so delightfully noisy with the songs of the many native birds. I suspected the cause, and, as soon as I saw the 'strange little birds,' pronounced them to be those 'winged rats,' the English sparrows. For twenty years I had kept several boxes for martins at my own place. About thirty pairs were making their homes at my doors. Suddenly I missed them, but the screech of a pair of English sparrows took

their place. Well, we exterminated these sparrows, and our birds came back. C. I.

Oregon, Mo., Jan. 1.

The discussion of the merits of the English sparrow, as shown in the contributions to *Science*, indicates a wide difference of opinion. Some of the conclusions reached by your contributors are unwarranted by any facts based on a thorough knowledge of the bird's habits as known in this country. It is very convenient to join in the cry of enemy, thief, pest, and like epithets; but that is not a scientific method of reaching conclusions. We want a bill of particulars, more facts and less crusade against these 'assisted emigrants.'

They are charged with driving out other birds from our city. My home and place of observation being within twenty-five miles of New York City, I can speak from careful observation that this charge has but little value in this locality.

Very few birds care to dwell in cities, except in the suburbs. It is neither congenial to their taste nor adapted to their requirements, while the English sparrow is essentially a native of a city, finding comfortable shelter and abundant food wherever partially digested grain may be found, in stables or along the highways travelled by horses. Excepting in the spring and summer months, this waste material is the almost exclusive food of this bird. Now we will consider the country life of this sparrow.

They are charged with destroying our crops. Have the farmers of this country made this complaint, or must we echo the tirade from abroad? As a farmer, my observation is, that the amount of wheat this bird appropriates during the few days of harvesting is too insignificant for notice. I know of no other grain that is molested in the slightest degree. That they are large destroyers of insects during the summer months, every observer knows. The army-worm finds in the English sparrow one of its most vigilant enemies. As to the garden fruits, we find that it molests none, and kindly leaves all the cherries to the robins and cat-birds. I have many grape-vines trained against my buildings, with an abundance of sparrows roosting amid the clusters of grapes, and have wondered at the sparrow's poor judgment in not tasting a single bunch. Such is my observation of this bird: social in its habits, apparently of the most happy disposition, but at times pugnacious with his relatives, which encounters are never fatal in their consequences. Certainly it is no concern of ours; for they seem to possess, in a remarkable degree, the spirit of forgiveness, and live, on the whole, in great social harmony. We rightly know them as pest when they soil our piazzas and deface our window-casings. J. D. HICKS.

Old Westbury, N.Y.

Equality in ability of the young of the human species.

"We have a pernicious habit in this country of supposing, that . . . all men . . . are born equal as to their abilities." "We have a different theory in regard to horses."

"It would, perhaps, be a good plan, if the young of the human species were divided into two groups at an early age,—one large, and one small; one composed of those of whom nothing more than plain living is expected, and the other composed of the race-horses, of those whose ancestors, or whose chance endowments, give reason to hope that they may give some aid to learning or to culture. Any one whose destiny is to do difficult thinking in after-life should . . . dwell long among the geometrical concepts, should become thoroughly imbued with the bare and rigid form of reasoning, and should have the results as familiar as his mother-tongue."

A criticism of a recent book on geometry, in *Science supplement* of Jan. 1, gives occasion to the critic to give the above views of a topic much wider than that of geometry. He would differentiate the human species into two groups, — the race-horses and dray-horses,— and train them accordingly, and the basis of the differentiation would be 'ancestry,' or 'chance endowments.' Suppose this had been done in the past, what chance is there that Watt, Stephenson, or Ericsson would have become known as engineers; Franklin, Faraday, or Edison as electricians; Napoleon or Grant as soldiers; Lincoln or Garfield as statesmen; Livingston as an explorer; Carlyle as a writer? Is it not notorious that most great men have not been descended from distinguished ancestors, and that in most cases their chance endowments have not been discovered, either by themselves or by their friends, until the age of manhood? The habit in this country, of supposing all men born equal as to their abilities, has had ample justification in the past, and may have in the future. Among the poorest families in the farthest west there are many Grants, Lincolns, or Garfields; among tallow-chandlers' clerks there are Franklins; among Scottish farmers there are Carlyles; the poorest weavers may produce another Livingston; and some obscure Corsican may be another Napoleon. We of the American branch of the Anglo-Saxon race have all a good ancestry. Six generations back, each of us had thirty-two male ancestors, at least one of whom must have been distinguished as a king, a statesman, a general, a thinker, or possibly as a 'gentlemanly scoundrel,' or freebooter; and all American babies are born with some 'chance endowment,' which, if given the proper environment, will develop into ability. But, alas! the chances are that the growing child will not be given the proper environment. He may have the ancestral traits or the chance endowments which would lead him to be a great soldier, an artist, an engineer, or a farmer; and he will be sent to school, where all these traits or endowments will be repressed, and his education will tend to make him a storekeeper or a politician; or he may not be sent to school at all, and ancestral poverty may be the cause of his remaining a coal-miner or a 'farmer's hand' all his life, and Gray's 'Elegy' may be used as his epitaph.

Whether the young of the human species will develop into race-horses or dray-horses is not generally determinable by ancestry or by 'chance endowment,' but rather by environment during youth and early manhood. The youth has the ancestry of both dray-horse and race-horse combined, and the 'chance endowments' are numerous enough to include some of the qualities of both. Better assume that the young are born equal in ability, and in their early training, beginning with the kindergarten, give them an equal chance to develop into mechanics, storekeepers, artists, farmers, or lawyers, than to differentiate them into the classes of race-horses and dray-horses at the beginning. W. K.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 8, 1886.

THE PALACE OF THE KINGS OF TIRYNS.

"THE untiring enthusiasm and liberality of one man have earned the gratitude of all civilized races, so long as the human past shall have any interest for mankind." These were the words with which one of the most accomplished of English scholars welcomed the appearance of Dr. Schliemann's narrative of his explorations at ancient Mykenae. And now we have to thank him for another volume,[1] equalling in interest the four he has already given to the world of letters, and even surpassing them in the beauty of its mechanical execution. Moreover, we think he has displayed sound judgment in allowing his learned collaborators to contribute the major part of the text of the present volume, for it is by his energy and success as an explorer that he will be always remembered. He is neither a learned scholar nor a trained archeologist; and, where he has relied solely upon his own resources in setting forth the results of his researches, he has frequently drawn conclusions which have met with but little favor at the hands of scholars. From similar failings the present work is by no means exempt: but such blemishes, like patches on the cheek of beauty, only heighten the intrinsic merits of this most important contribution to our knowledge of the ancient world; not to our knowledge of what is commonly understood by the phrase 'prehistoric times,' — for we think it a misnomer to call what he has brought to light 'the *prehistoric* palace of the kings of Tiryns,' who, as he thinks, flourished some fourteen hundred years B.C., — but to our accurate comprehension of the heroic age of Greece, those early times about which, hitherto, the Homeric poems have been our only source of information. We may well be grateful to him for the light which has thus been shed upon many an obscure passage or questionable statement in those earliest records of the western world. But in regard to what is known in archeology as the 'prehistoric period,' by which is to be understood a certain stage in the development of civilization, Dr. Schliemann seems to entertain very misty notions. He speaks of finding in the ruins of the palace arrow-heads of obsidian "rudely made: in fact, as rudely as the arrow-heads of silex found in the cave-dwellings of the age of the mammoth and the reindeer in the Dordogne, in France, and to be seen in numbers in the prehistoric museum at St.-Germain-en-Laye" (p. 78). But no such things exist as rude arrow-heads found in the caves of the Dordogne; and it is one of the commonplaces of prehistoric archeology that in the paleolithic period, to which these caves must be referred, bows and arrows had not yet been invented. He gives four drawings of these remarkable 'arrow-heads,' which precisely resemble four similar objects that the writer picked up upon the slopes of the Acropolis at Athens. But they are only fragments of obsidian flakes, which are abundant upon prehistoric sites in Greece; and they merely prove that a particular spot was occupied by man in the stone age. Yet the finding of these bits of stone, accompanied by fragments of rude, hand-made pottery, in the *débris* of the palace, furnishes our author his main argument to prove that it was destroyed in prehistoric times. But it is a common thing to find such fragments as these disseminated throughout the soil in the places where they occur; and, although Dr. Schliemann may have come upon them in the earth that has accumulated above the ruins of the palace, their presence proves nothing more than the antiquity of the site, whether it be at Tiryns or at Athens. But Dr. Schliemann can actually believe that such rude arrow-heads as these were still in use contemporaneously with the occupation of the remarkable edifice he has disinterred and described. His own excavations, however, at Mykenae had already disclosed the kind of stone arrow-heads employed at the close of the high civilization of the bronze age, — exquisitely fashioned out of obsidian, of the Solutré type, thin, delicate, and provided with barbs.

So, again, he argues for a very high antiquity for the earliest remains he has discovered, because he finds among them a kind of rude, hand-made pottery, consisting of vessels, or portions of them, provided with handles pierced with two perpendicular holes for suspension; while, of those having similar horizontal perforations, two examples only were met with. The former kind is not uncommon in the Swiss lake-dwellings, and in some other localities belonging to the Neolithic period; and he quotes Professor Virchow as authority for inferring from such similarity 'a direct connec-

[1] *Tiryns: the prehistoric palace of the kings of Tiryns.* The results of the latest excavations. By Dr. HENRY SCHLIEMANN. With preface by Prof. F. Adler, and contributions by Dr. William Dörpfeld. New York, *Scribner*, 1885. 4°.

tion' between the two places (p. 64). Virchow, however, had many other points of resemblance which are wanting at Tiryns, besides this single one, to bring forward, between the rude, early pottery of the two sites he was comparing.

The stages of civilization of the lake-dwellers of Switzerland and of the Homeric heroes differ as widely as does the dawn from high noon; and the endeavor to relegate the occupants of a palace whose artistic decorations excite only wonder and admiration to the status of the age of polished stone, or even of the early bronze age, displays a singular misapprehension of the teachings of prehistoric archeology.

That the huge, so-called Cyclopean walls of Tiryns should have inspired the belief in their hoar antiquity, and that around them should have clustered myth and legend, is not to be wondered at. The strange circumstance is, that it is in the later writers principally that this crop should have sprung up. It is worthy of remark that Tiryns is mentioned but once in the Homeric poems, and that only in the 'Catalogue of forces,' which by most scholars is regarded as a late interpolation. There it is characterized by an adjective which means 'the well-walled' (Iliad, ii. 559), and our author thinks that "Homer expresses his admiration for the walls by this epithet, which he bestows on Thebes" (p. 17). The fact is, however, that this word occurs in only one other passage in the poems, some hundred lines after its first use; and there it is applied, not to Thebes, but to the ancient city of Gortys, in Crete. This is the place where last year was discovered the longest and most important inscription yet known in the archaic Doric dialect, probably of the sixth century B.C. But at Gortys there are no Cyclopean walls, and we feel constrained to believe that the epithet was employed by the poet in both instances solely for its metrical advantages.

Leaving, then, the Homeric poems out of the case, there is no question that these huge walls have stirred the wonder and admiration of all modern travellers, and many have been the attempts to account for them, and to discover who were their builders. We can hardly, however, look upon Dr. Schliemann's as the most happy solution of the problem. He thinks that "we may assume with great probability that they were built by Phoenician colonists, and the same is probably the case with the great prehistoric walls in many other parts of Greece" (p. 28). How is it, then, we may ask, that a precisely similar style of construction is to be seen in mountain fastnesses in the Apennines of central Italy, where no foot of Phoenician trader ever penetrated, while no such example is to be found in Phoenicia proper, or in her greater daughter, Carthage? Much more probable seems to be Mr. Gladstone's conjecture that they are "the handiwork of the great constructive race or races made up of several elements, who migrated into Greece, and elsewhere on the Mediterranean, from the south and east." But we doubt if the key to the mystery is to be sought in peculiarities of construction; since archeologists now are of one accord that the huge polygonal style of building, in all of its different varieties, to the rudest of which alone the epithet 'Cyclopean' should be restricted, arose from the natural cleavage of the material used for building-purposes.

Equally unsatisfactory seems to be Dr. Schliemann's attempt to overthrow the established date of the destruction of Tiryns by the Argives, 468 B.C., in favor of a period so much anterior to this as the return of the Herakleids, which he places at about 1100 B.C. In this, it is true, he is sustained by the authority of that most hardy of the investigators of ancient history, Professor Sayce, while Professor Mahaffy also rejects the received chronology. But it is certainly suggestive that the very passage in the Iliad (iv. 52) which is cited by Professor Sayce in confirmation of such a theory, should have been previously brought forward by another eminent iconoclast, Professor Paley, as equally conclusive to establish the comparatively late date of the existing version of the Homeric poems.[1] But the universal consensus of historians, backed by the irrefragable testimony of the bronze serpent, which once supported the golden tripod dedicated by the Greeks at Delphi in commemoration of the battle of Plataea, and which is now to be seen in Constantinople, would seem to outweigh our author's archeological evidence in support of his new view, which would appear to consist of a *graffito* in eleven archaic letters scratched upon a bit of 'lustrous black Hellenic pottery,' re-enforced by numerous rude female images, which possibly may be only archaistic, and which, at any rate, bear a striking resemblance to the children's playthings found in the tombs at Athens.

But enough, perhaps too much, has been said about our author's theories: let us turn to some of the actual gains to knowledge acquired by his liberal use of the spade at Tiryns; only we must first enter our protest against his failure to do justice to his townsman, Dr. Rhaugabé. Referring to the appearance of the site before he commenced operations there, he says, "Many of the walls were visible on the surface, and had misled the best archeologists, as they were assumed to be

[1] Transactions of the Cambridge philosophical society, xi. p. 383.

mediaeval, and it had never been imagined that they could be perhaps two thousand years older, and belong to the palace of the mythical king of Tiryns" (p. 8). Who would suppose, upon reading this, that twenty years ago Dr. Rhaugabé, in his 'History of ancient art' (p. 63), had stated that "it is highly probable that these are the remains of the primitive palace of Proetus"? We have here an instance of the same self-complacency which manifests itself also in a remark about his "excavations in the prehistoric tumulus on the plain of Marathon, which previously had been wrongly regarded as the tomb of the one hundred and ninety-two Athenians who fell in the battle" (p. 78). Dr. Schliemann seems to have never read Byron's well-known verses upon Marathon and 'the violated tomb,' and not to know that years ago the tumulus was explored by a Frenchman; which may, perhaps, explain why our author found so little in it, even if its situation itself, in a sandy plain hard by the water's side, would not be sufficient to account for the disappearance of the bones of the heroes who were buried under it, as we may fairly infer from what Thucydides and Pausanias and Kritias tell us.

The first decisive result of the explorations at Tiryns has been to establish the fact of the existence there of two successive structures, built upon a limestone rock which rises to a slight elevation above the surrounding plain. The primitive fortress was constructed of sun-dried bricks and wood, according to Professor Adler, and traces of the sub-structures of a huge gate-tower belonging to it were discovered under the foundations of the palace (p. xii.). Remains of its walls built of rubble and dry mortar of clay were found by Dr. Dörpfeld, buried deep in *débris*, through which a trench had to be dug before the foundations of the terrace-wall of the upper citadel could be laid (p. 252). Besides these proofs drawn from the construction, there were found among its ruins numerous fragments of rude pottery, mostly hand-made, though in some instances showing a knowledge of the potter's wheel, which presents so great a contrast in form, *technique*, and decoration, to the pottery occurring in the ruins of the subsequently erected Cyclopean palace, as to prove, in Dr. Schliemann's judgment, that they are the work of totally different peoples. This opinion is based upon arguments derived from the continuity of style always to be observed in the art-products of the same race, even at very different periods, which he ascribes to Mr. Dennis, but which really ought to be credited to Professor Brizio (p. 57).

But the crowning achievement of Dr. Schliemann's labors has been the discovery that those vast walls, piled up, of huge unhewn stones, so massive that in the exaggerated language of Pausanias "a yoke of mules could not move the smallest of them from its place," were raised for the defence of 'a lordly house,' of which the uniformity of design in its ground plan, and the skilful distribution and arrangement of all its parts, have given to the trained eye of an architect a most favorable impression of the builder's talent and experience. It is indeed a revelation to the world that the high stage of civilization which the Homeric poems disclose was not merely a poet's dream. In the glowing language of Dr. Dörpfeld, "we see the mighty walls, with their towers and gates, and enter into the palace by the pillar-decked Propylaed. We recognize the men's court, with its great altar, surrounded by porticos; we see, further, the stately Megaron, with its anteroom and vestibule; we even enter the bath-room, and finally pass on to the women's dwelling, with its separate court and numerous chambers. This is a picture which floats before the mind of every reader of Homer, — a picture which many a *savant* has endeavored to restore after the data given by him. All such attempts, hitherto, have been to some extent unsatisfactory. There always remained questions to which all the acuteness in the world, on the part of Homeric scholars, could give no answer in the words of the poet. Many of these riddles are now solved by the palace at Tiryns" (p. 192). But to attempt even the briefest *résumé* of the interesting and instructive chapter in which Dr. Dörpfeld has given a detailed account of the plan of the citadel, and the singular method of construction of its walls, with their covered galleries and concealed chambers, of the arrangement of the approaches to it and the hitherto unknown stairway conducting to the postern gate, and finally of the palace itself in all its several parts, and the building-materials employed in it, as these all were brought to light in the explorations of the summers of 1884 and 1885, — this would far exceed the space at our command. We can only refer to some remarkable discoveries, which throw light upon the character of the civilization to which the building belongs, and which are most striking from their novelty.

We think the series of nine plates, in which are depicted fragments of plastered walls, painted with frescos in five different colors, cannot fail to stir the admiration of every lover of the beautiful, whether he be a student of antiquity, or not. Who could have imagined that the palace walls, in the Homeric age, were ornamented with decorations which for beauty and grace of design, and freedom and boldness of execution, surpass the fresco-painting of our own day? What life and power

the figure-piece of the bull-tamer, leaping upon the back of the beast in full career, displays! The beautiful frieze made of slabs of alabaster, decorated with sculptured ornaments and inlaid with pieces of dark blue smalt, is most interesting, not only for its intrinsic elegance, but for the confirmation it has given to a conjecture of Helbig in explanation of one of the Homeric puzzles, the nature of the frieze of *kyanos*, which adorned the palace of Alkinoös (Odyssey, vii. 86). This is the substance which Mr. Gladstone supposed to have been bronze, and which Mr. Evans, following the general opinion, has reluctantly conceded to have been dark blue steel, but which we now have every reason to believe to have been a blue glass paste. Another surprising discovery was the bath-room, containing a fragment of a bathing-tub, made of thick terra-cotta, and resembling in form similar articles in use to-day. After such a substantiation as this, of the numerous instances in the Homeric poems where mention is made of the 'well-polished bathing-tubs,' we may perhaps feel warranted in believing that in the heroic age sometimes these were actually made of silver, like the two which 'Polybus, who dwelt in Thebes in Egypt,' gave to Menelaus (Odyssey, iv. 128).

Reluctantly we lay aside this interesting volume, fully sharing in the regret expressed by Dr. Dörpfeld at the fate that must speedily overtake much of what has thus been brought to light after its sleep of centuries in the lap of mother-earth. He says that it is doomed to certain destruction, although the Greek government intends to do all in its power to protect the palace with a roof and in other ways (p. 259). But even if the material parts must perish, its teachings have been embalmed forever for posterity in this noble volume, which, as we said at the outset, we owe to the liberality and enthusiasm of Dr. Schliemann.

WINTER ON MOUNT WASHINGTON.

THERE are three distinct types of winter weather on Mount Washington that offer good illustration of the control of wind over temperature. The most common, and certainly the one most frequently associated with the popular estimation of the mountain's weather, appears with the westerly or north-westerly winds of considerable strength that blow between a centre of low barometric pressure lingering over the provinces or in the Gulf of St. Lawrence, and a centre of high pressure on the lakes or in the Ohio valley. The sky is clear or fair, the wind blows fifty to eighty or more miles an hour, and the temperature falls to a point worthy of newspaper items. This is the time of hardship for the observers in the signal-service station: clearing the anemometer cups of the frost-work that forms on them is then no pleasant task; but, if not cleared, the frost-work fills the cups, and prevents their proper turning, or they become so heavy that the centrifugal force of their rapid whirling may tear them from the axle. The cold is so intense and penetrating with the high wind, that the stoves have to do their utmost to keep the station habitable. A conflagration at such a time would be almost certain death to the men, for they could not descend the mountain in such weather.

On the 29th of last January there was a sample of this type: a storm-centre had passed the day before; the wind shifted from south to north-west, and rose to one hundred miles an hour, — if the records in recurring round numbers can be accepted as precise, — and at seven o'clock in the morning the temperature was $-32°$. At the same time, the temperature at Boston was $0°$; at Portland, $2°$; and at Montreal, $-9°$. The cause of the extreme cold on the mountain is, first, that its winds come rapidly from the cold north-west, without having time to warm up very much on the way; and, second, that they are forced to rise more or less in passing over the mountain, and thus are cooled by expansion about half a degree for every hundred feet of ascent. In other words, the cold is chiefly imported, but is partly a home product. The temperature is not excessively low: it is higher than the records give for the far north-west, and much higher than the minima known in Siberia; but it is harder to bear on account of the terrific winds that accompany it. Residents in Montana and Siberia unite in having a good word for the calm, dry cold of their frigid winters, but no word of praise for the windy cold on Mount Washington appears in the signal-service reports. Other examples of this type, illustrated in the old reports and maps, are Dec. 30, 1873; Jan. 16, 17, 25, 26, 1874.

The second type appears when the mountain stands a moderate distance from a storm centre, generally to the east or north of it. The temperature is then relatively high, and the weather cloudy or rainy. Jan. 16, 1885, will serve for an example of this. The storm-centre was then to the west of the mountain, but not far away, as the wind was from the south, sixty miles an hour. It was snowing, and the air was nearly 'saturated' with vapor; the air temperature at 7 A.M. being $29°$, and the dew-point $28°$. At the same time, the temperature at Boston was only $32°$, while that at Portland was $24°$. Montreal failed to report that morning, but was undoubtedly colder still. Now, if there is any propriety in averages, Mount Washington ought to be in win-

ter fifteen or sixteen degrees colder than its neighboring sea-level stations. Here it is as much too warm as it was too cold in the first type. Although it is near the storm-centre, where the winds are supposed to ascend obliquely, the air on the mountain is evidently not derived from the low-level stations near by; for, independently of the evidence furnished by the wind's direction and velocity against such a conclusion, the temperatures disprove it. If a current of air ascend from sea-level to the top of Mount Washington, its temperature must fall at least eleven degrees, even if the cooling from expansion were retarded by condensation of vapor through the whole ascent. The surface source of the wind, if it come from the surface at all, must therefore be sought many miles south of New England, in the southern states or on the Gulf Stream, where the temperature is fifteen or twenty degrees higher than in Mount Washington latitudes. Then, as in the first case, the temperature on the mountain is largely a matter of importation; but now the cooling by ascent abruptly up the mountain sides, or gradually in the cyclonic whirl, acts to destroy the imported characteristics of the wind, instead of to confirm them, as before. In the pronounced examples of this type, when it is warmer on Mount Washington than at Boston, we find illustration of the inversion of temperature, that is generally held to be peculiar to anticyclonic weather, as will be explained below; and although such cases are not, so far as I know, characteristic of other mountain stations, they are not rare on Mount Washington. Examples may be found on the old maps for Dec. 3, 27, 1873; Jan. 7, 8, 27, 28, 1874. The warm waters of the Gulf Stream, and the rapid decrease of temperature with latitude along our eastern coast, must be chiefly responsible for this. Another factor of hardly less importance is the fivefold greater velocity of the winds at the height of Mount Washington over those at the earth's surface. As a storm-centre draws near, the winds on the mountain may be derived from a source four or five times as distant to the south as that which supplies the low-level stations. Thus the ordinary decrease of temperature with height is overcome. Montreal is decidedly colder than the three other stations at such times; for it is well to the north of the storm-centre, and draws its winds from northerly sources.

The third type is one that has attracted much attention in Europe of late years, on account of the very abnormal temperatures that accompany it. It appears when a centre of high pressure — an anticyclone — passes over the mountain, and, when fully developed, it causes a remarkable inversion of weather elements. We are accustomed to see mountain-tops cold and cloudy, while the valleys about them are warmer and clear; but anticyclonic weather places the cold and the clouds in the valleys, while the peaks rise into brilliantly clear, warm, dry air. Dr. Hann was the first to give a full explanation of the facts, in 1876, and I follow him in this statement. In an anticyclone, the few lofty clouds that are observed generally move towards its centre; the surface winds move outwards to all sides; with converging currents above, and diverging below, there must be a descending current about the centre; the descent is probably slow, but it undoubtedly exists. This type, therefore, involves the consideration of the temperature of air derived from regions of the atmosphere far above the mountain-tops. The first opinion that one would have of such temperature would probably be to place it well below freezing, for we are all familiar with the excessive cold experienced in very lofty mountain ascents and balloon voyages. But this is wrong. Although undoubtedly cold while up aloft, air that descends from the upper regions is compressed as it comes under greater atmospheric weight near sea-level, and it is thereby warmed. A current coming down from a moderate altitude in summer might be cooler than the surface air; but in winter it would be in practically all cases decidedly warmer. The statement of this fact is not particularly new, but its recognition and general application are a recent progress in meteorology. More than forty years ago, Arago, Pouillet, and Babinet reported to the French academy that "it is proved by the investigations of Mr. Espy that one should not hereafter attempt to adduce, in the mean state of the atmosphere, a descending current of air as a cause of cold."

It is, then, to the descent of air from aloft that we are to look for the abnormal warmth and dryness of mountain-tops in anticyclones. It remains to account for the extreme cold that prevails at the same time in the neighboring valleys. An illustration of the contrast is given by Professor Upton in the second Bulletin of the New England meteorological society. On the morning of Dec. 27, 1884, when the winds were everywhere light, and the pressure higher than on the days before or after, the temperature on Mount Washington was +16°; at the low-level stations north of Massachusetts, it was −10°, or colder. On consulting the records, I find Grafton and Littleton, N.H., −18°; Hanover, N.H., and Newport, Vt., −20°; Woodstock, Vt., −27°; Portland, Me., +7°. The lower cold must therefore be in spite of, not on account of, the down-cast current; and we are forced to believe that it is caused by rapid cooling of the ground, and of the air close to it, by

radiation through the clear, dry air above. It is not at first apparent why the ground should cool to an excessively low temperature, while the air above it remains comparatively warm: it is because solids can cool by radiation. just as they can warm by absorption, much more quickly than gases. For this reason, the upper air changes its temperature but little from day to night; while the ground, and to a certain extent the air near it, have a large diurnal range. Now, during an anticyclone, radiation from the ground is rapid through the clear, dry air; thus the temperature falls very low, and the air on or near the earth's surface is greatly cooled. If the descent of the air were rapid, radiation would not have time to overcome the warmth gained by compression; and it is known, that, when the surface wind springs up in an anticyclonic centre, the temperature rises with it. But generally the descent is slow; and, when near the ground, the down-current turns aside as a slow horizontal outflow; it becomes heavy as it is chilled, and tends to collect and stagnate in depressions. Ground fogs form when the dew-point is reached, and then the contrast is complete between the clear, pleasant weather on the peaks, and the cold, damp air in the valleys. In the first and second types the temperature is chiefly imported: in the third it is essentially of local origin over the mountains. December, 1879, gave a famous example of an inversion on a large scale in Europe, and much was written about it. An enterprising mountain-climber ascended a peak in the Alps east of Lake Geneva on Christmas day, and was rewarded by rising above the dense clouds that covered the lake and filled the cold valleys, and finding fine, clear, relatively warm weather on the mountain-top. A few examples of such inversions must make our observers wish they were in a region of permanent high pressure, instead of in one of the stormiest countries of the world. W. M. D.

JAPANESE HOUSES.

THE opening of the empire of Japan to foreign intercourse has furnished more subjects of inquiry to the student of human development than any event of recent times. Here is a nation which has been secluded for centuries from all except the most insignificant external influences. During this seclusion, modern European civilization, with its science and arts, its comforts and refinements, has virtually come into existence. In the mean time, the secluded nation, mainly without help or hindrance from its neighbors, has been engaged in working out the problem of its national life in its own way. Suddenly the curtain is raised, and we are permitted to look in upon the spectacle so long in preparation. For a quarter of a century we have been studying the scenes thus revealed to us, and have not yet fully succeeded in making out their meaning.

That the Japanese race is one possessed of native vigor and resources is shown by the outcome of this long experiment of isolation. With all the disadvantages arising from the want of free foreign intercourse, they have made such progress in the arts of civilization as to challenge our admiration. In intellectual activity, in warlike and chivalric achievement, in gentle and amiable manners, in the refinements and amenities of life, they may certainly bear favorable comparison with the most cultured races. They present to us a strange mixture of excellences and defects. While as a nation they are conspicuously brave and warlike, they have devised and developed few formidable implements of war. They have built great cities, and conduct a vast system of trade; and yet their ships and warehouses, and public and private buildings, seem, by the side of ours, fragile and temporary. They manufacture the most exquisite and tasteful fabrics and wares, and yet the mechanical appliances of their arts are rudimentary.

We are thankful to any one who will help us to gain some insight into the character and life of such an interesting people. It was a most happy thought of Professor Morse to make a careful study of the Japanese house. Nothing can aid us more in understanding the life of the occupant than to describe his dwelling-place and the implements and furniture which he gathers into it. Fortunately for us, the author of this book combined in himself the faculty of the scientific observer and the skill of the artist. We may safely say that here, for the first time, we have intelligible sketches of the Japanese dwelling-house, and intelligible explanations of the uses and arrangement of its furniture. Heretofore we have had chiefly photographs of exteriors and gateways and street scenes, or, instead of that, we have been treated to reproductions of native Japanese drawings by engravers who did not understand the drawings. It is the experience of every stranger visiting this country, that, notwithstanding all that he has tried to learn from books about Japan, he is as much amazed at the real Japanese house and surroundings as if he had never seen an illustration of them. Professor Morse, on the contrary, has gone about with eyes in his head and a pencil in his hand. The minuteness and

Japanese homes and their surroundings. By EDWARD S. MORSE, with illustrations by the author. Boston, *Ticknor*, 1886 [1885]. 8°.

accuracy of his information surprise us at every page. It must be confessed that it required a good degree of enterprise and assurance to have secured some of his sketches. The Japanese are a most amiable and polite people; but they must have been amazed, and perhaps amused, at the persistency with which the artist went about peering behind their screens, under their mats, and into their closets. We, however, have no reason to complain; for he has seen for us far more than we could have seen for ourselves, and has brought to us such a budget of facts, and such a portfolio of illustrations, as we could not have gathered for ourselves in a lifetime.

In any country a dwelling-house is the product of complicated causes. Climate, the prevalence of destructive agencies, the character of the material available, the skill of the mechanics, the wealth of the people, the growth of artificial physical wants, the development of a taste for the beautiful and refined in life, — all these are potential causes in determining the character of the dwelling. These causes account for most of the peculiarities of the Japanese house, as compared with our own. From time immemorial, Japan has been visited by earthquakes and typhoons. These will explain why the Japanese builds his house as low as possible, and prefers wood to stone. The climate is mild, and does not demand the formidable provision against the cold with which we are familiar. This may account for the absence of chimneys and stoves. It puzzles us, however, to understand why the Japanese, who has shown such cleverness in the development of many of the arts of civilized life, has made so little progress in others. In 1542 the Portuguese landed on the southern islands of Japan, and left there, among other traces of their visit, a number of the matchlock guns which were in common use in Europe at that time. After the lapse of more than three hundred years, you can see the hunter of to-day out on the hills with a gun which is of the identical pattern which the Portuguese brought thither. The Japanese gunsmith has found out how to make the matchlock a far more ornamental weapon than it was in the hands of the Portuguese. He has decorated the stock, and inlaid the barrel with gold and silver, and provided it with exquisite fittings; but still it is the same old matchlock, without a single effective part changed or improved. Such absence of progress is surprising; but it does not surprise us half so much as their marked superiority in other and more difficult arts. In the modelling and decoration of pottery; in ornamental metal-work; in weaving and embroidery; in painting, carving, and enamelling; in the exquisite workmanship of their lacquer wares, — their achievements put them in the very first rank.

In all these departments of industry the Japanese now have an acknowledged position. It has not been so well known that in many of the humbler departments their work is scarcely less to be admired. Professor Morse has given us, in this volume, sufficient evidence of the excellence of their carpentry and joinery, of their skill in gardening, and of their cleverness in making both house and garden contribute not only to the physical comfort, but to the intellectual pleasure of the occupants. We are specially indebted to the author for exhibiting to us so clearly the internal arrangements of a Japanese dwelling-house, and the domestic routine which goes on in it, and the evidences of comfort and refinement which are everywhere seen. The beautiful products of their ornamental arts have become familiar to us, and are almost as much at home in our houses as in theirs. But the implements of common life are still strange to us; and we are thankful to Professor Morse, who, in this book, has given us so much information about them. I need only mention such illustrations as those of a carpenter's tools, of a thatched roof, of the interiors of dwelling-houses, of a kitchen range, of their bath-tubs and lavatories, of their candlesticks and lamps, of their wells and water-buckets, of their gardens and garden-lamps, to show how varied and interesting are the contents. We are sure that Professor Morse's portfolio is not yet exhausted; and it only remains for us to express the wish that in due time he may open for us another instalment of his delightful wares.

PHYSICAL EXPRESSION.

IN the term 'physical expression,' Dr. Warner includes all those changes of form and feature occurring in the body which may be interpreted as evidences of mental action. Such changes are taking place constantly, and in response to all kinds of mental impressions. The majority of them are involuntary, and, so far, trustworthy, it being the height of art to simulate a feeling successfully. At first thought, it would seem that facial expression is the most important of these outward signs of inner processes; but a little observation will convince one that the posture assumed by the body, — the poise of the head and the position of the hands, — as well as the many alternations of color and of general nutrition, are just as striking evidences of the course of thought. And such changes may be permanent as well as

Physical expression: its modes and principles. By FRANCIS WARNER, M.D. (International scientific series.) New York, *Appleton*, 1885. 12°.

temporary, thus displaying the general caste of mind as well as the transient emotion by which the individual is excited. The subject thus developed by the author becomes quite extensive, and is exceedingly interesting. By studying it in animals and infants, in whom the higher mental control which often modifies involuntary changes of expression in adults is absent, by showing its practical application in enabling one to read character, and by drawing from the realms of art as well as nature for his illustrations, Dr. Warner has succeeded in bringing together an entertaining series of facts, and deducing from them some instructive conclusions. We all believe that we can detect the real feelings of others in their faces, and that we can successfully conceal from others our own thoughts. How difficult both processes may become, and yet how fully they repay some study, the readers of this very pleasing work will learn.

In the last chapter the author describes an ingenious piece of apparatus by means of which the motions of the hand may be graphically recorded in those diseases in which irregular movements occur. He has evidently made some study of such affections, as the facts recorded in chapter vii. show. How far such a chapter may be generally appreciated in a popular work is questionable, as the terms employed would be intelligible only to physicians. But the subject would have been incomplete had the changes of expression incident to disease not been alluded to. To those who are curious to go into the subject more deeply than is possible in a popular treatise, the bibliography on pp. 344–346 will be of service. The work is fully up to the high standard maintained in this series, and is by no means the least interesting of the volumes already published. M. A. S.

REFORMS IN ENGLISH PUBLIC SCHOOLS.

THE public schools of which Mr. Cotterill writes are British, not American, and his starting-point is ahead of any thing that can be proposed as an immediate goal in other countries, — ahead, at any rate, in this, that English public schools already, as a matter of fact, are nurseries of *character* quite as much as institutions of learning. Mr. Cotterill's suggestions are mostly in the line of character. Health of character is for him the end of education. He is down on competitive examinations of a severe sort, would have a test of proficiency in bodily exercises introduced into those of the Indian civil service, believes in making out-door exercise compulsory on all boys three days in the week, each boy 'changing into his flannels' for the purpose, would restrict the 'tuck-shop' facilities the boys now have, and disbelieves in giving them too much help, whether intellectual or physical. Translations, and aid from the teacher beyond a certain point, are in his eyes equally bad; and the boys ought to prepare their own cricket-grounds, and take care of their own play, with less professional aid than they now appear to get in the larger schools. He believes in 'manual training' thoroughly, for a variety of reasons, not least among which is that it widens sympathy among classes. The book is a refreshing example of the sort of spirit the English public schools, even in their present 'unreformed' condition, engender, and increases the reader's desire to see them imitated here on a larger scale than heretofore.

Suggested reforms in public schools. By C. C. COTTERILL, M.A. Edinburgh and London, *Blackwood*, 1885. 12°.

THE government of Tasmania are, according to *Nature*, making arrangements upon a large scale for naturalizing lobsters, crabs, turbot, brill, and other European fishes in the waters of that country. The various consignments will be shipped at Plymouth, and transported through the medium of the steamship companies trading between London and Hobart. An exhaustive report has been published by the Government of Tasmania, setting forth the objects in view, and giving suggestions for carrying them into effect. The report adds, that, while the achievement of the acclimatization of European fishes would lay the foundation of new and very valuable fishing industries in Tasmania, it might also prove a highly remunerative commercial enterprise to the shipping firms under whose auspices the operations will be conducted. Applications have been made in various quarters for supplies of fish, which have been satisfactorily responded to. Special tanks are being prepared, as well as apparatus, in order to provide for the necessities of the fish *en route*, which, it is anticipated, can be transmitted with little difficulty. The success that has hitherto attended the acclimatization of certain European fishes in New Zealand has had the effect of inspiring the government of that colony with considerable enterprise in developing their fisheries. They are now about to collect the ova of Salmonidae from English waters in large numbers through the instrumentality of the National fish-culture association and other bodies, with a view to rearing the fry in New Zealand. A shipment of eggs will also shortly be sent to Australia, where great success has attended the introduction of our fishes, except in a few instances, when failure resulted more from misadventure than from the impracticability of the attempt.

SCIENCE.

FRIDAY, JANUARY 15, 1886.

COMMENT AND CRITICISM.

LIKE ALL CITIES which have not seriously grappled with the subject of municipal taxation, Baltimore has been suffering for years from the inequality of assessment, escape of personalty from taxation, the difficulty in enforcing payment, and the practice of many persons who do business in the city, of residing part of the year in the country, and thus withdrawing personal property from taxation. To remedy matters, a commission was appointed last summer to investigate the question; and during the past week a report has been made, of more than local interest. No opportunity was given for radical changes, as the state constitution, which requires that all personal and real property shall be taxed on a uniform basis, stands in the way. The committee favor the creation of sixteen city assessors, to be appointed without regard to politics, and with a tenure of sufficient length to secure expert service. The assessors are to constantly review both real and personal property, and prevent evasions. Property is to be assessed up to its full value, and the system of discounts for prompt payment of taxes is to be abolished. On the other hand, as an aid to the poorer classes, taxes may be paid quarterly. Professor Ely of Johns Hopkins university, who is one of the commission, adds a supplemental report, looking to a change in the constitution. He would abandon the attempt to tax all personal property, and attempt only to reach such classes of personal property as bank shares, for instance, which can be assessed without discrimination. The larger proportion of personal property should be taxed only by indirect means. Real estate should be taxed at one uniform rate; all incomes in excess of six hundred dollars per annum; so, also, all rents of dwellings, taking as a basis three times the annual rent of dwellings, in lieu of miscellaneous personal taxes; and the rental value of all stores, offices, manufacturing establishments, and other places of business, the rent being fixed at ten per cent. He recommends a special heavy taxation on retail and wholesale liquor-dealers, and finally favors the plan of deriving all state taxation from corporations and licenses, thus leaving real estate for local purposes.

TYPHOID-FEVER is a disease which has too long been permitted to exist without a well-directed effort to diminish its ravages. Although the specific micro-organism to which it is due is not so definitely ascertained as in the case of tuberculosis, still there are but few who question the relation of cause and effect between some microbe and the disease. It is also conceded that this germ is given off in the excreta of the patient, and that the spread of the disease is caused by the inhalation of air containing the germ, or by the imbibition of water, milk, or other fluid which has become contaminated with the infected dejections. In rural districts, where the water is derived from wells which are often but a few feet from the out-house, there is no difficulty in understanding how the infection might pass from the vault to the well, and how those who partake of the water might contract the disease. In large towns and cities, however, where the water-supply is from a distance, and the ground from which it is obtained free from such contaminating influences, the propagation of the disease must be accounted for in some other way. Particularly is this so, when, as frequently happens, the disease prevails in restricted sections, and is absent elsewhere, while the water consumed is the same for all sections. Manifestly the starting-point for an investigation is the infected excreta, if the accepted theory is the true one. If these could be followed and their route ascertained, more especially if the course pursued by the infectious element could be traced, the mystery would disappear, and the problem be solved.

Recent observations made in Brooklyn, a report of which has appeared in the daily press, point to the sewers and the drain-pipes of the houses as the channels by which the disease finds its way from one house to another, and clearly indicates that the plan to be pursued, based on our knowledge of the history of the disease, is to throttle it at the start by thoroughly disinfecting the discharges of typhoid-fever patients before they are thrown into the drains or into the out-houses.

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Special attention has been directed in Brooklyn, during the past fall, to having this measure efficiently carried out, supplemented by repeated washings of the public sewers, in the districts specially affected, with a solution of chloride of lime. Shortly after these measures were inaugurated, the disease declined; but whether this was in any degree attributable thereto or not, cannot be decided until further observations are made. Thus far, a preliminary report only has appeared, but a fuller one is promised. It is well worthy the attention of all health authorities to follow out this or a similar plan of action; so that, if possible, a disease which caused in England alone thirty-six thousand deaths in six years, may be brought under control, and its spread confined within narrow limits. The report also recognizes the connection between defective plumbing and the spread of the disease (for, unless there were defects within the house, no infection could enter, even though the public sewers might be infected), and recommends the disconnection, by means of running traps, of all houses from the street-sewers, and the provision for full and free ventilation of both sewers and drains. Special stress is, however, laid upon the disinfection of the discharges within the house; for, if this is thoroughly done, neither the house-pipes nor the public sewers can become infected.

ONE OF THE MOST CURIOUS and important facts regarding the use of oil at sea in stormy weather to calm the waves is its apparent novelty to seamen. When in the last extremity, some of them 'happen to think of oil,' and, on trying it, find that the sweeping waves no longer break over their decks, and that the vessel rides with comparative ease where it labored heavily before. This is much as if a captain 'happened to think of the rudder' when he wished to shape a new course. The hydrographic office is accomplishing an excellent work in popularizing the practical value of this simple means of escaping danger.

A NEW JOURNAL is to be issued in France under the title *Archives de l'anthropologie criminelle et des sciences penales.* The study of criminals, from an anthropological and a psychological point of view, is due to the Italian school of which M. Beccaria was the founder, and which is now ably represented by MM. Sombroso and Ferri. The French interest in this subject is borrowed from Italy, and undoubtedly the French journal will aid in disseminating this interesting as well as scientific method of studying these defective classes.

THE U. S. S. RUSH sailed, Jan. 2, for the Aleutian Islands, in the hope of rescuing the crew of the missing whaler Amethyst, which it is thought might be there and in need of assistance. The winter climate of the Aleutians, though stormy, is rarely very cold, and the harbors are open all the year round. Most of the islands are uninhabited, and, from the absence of large animals, afford little food for a wrecked party, if cast ashore there. The visit of the Rush may save life, and prevent much suffering. The winter ice-line generally includes the Seal Islands, and it is likely that the Rush will not be pushed beyond the Aleutians, unless the weather be unusually favorable.

THE CITY OF MEXICO, for a number of months past, has been afflicted with a scourge of mosquitoes. These insects have prevailed to such an extent that they have been a constant theme of discussion, and have, in a number of instances, caused sickness, and, it is said, even death, by their poisonous bites. Official bulletins have been issued by the director of statistics, Dr. Peñafiel, seeking information as to their habits, natural history, etc. Singularly, the species, which is a large one, has not been known, or at least has not attracted attention before the past year; and fears are entertained that the pest is of recent introduction. The varying abundance of different kinds of insects during different years renders such a view improbable; yet it is significant that the present species is new to science, never having been described by entomologists.

IN CONNECTION WITH the article on the Russian railroads in central Asia, given on another page, it is interesting to note the following Berlin despatch to the London *Times*: "A government circular has been sent to all the newspapers, forbidding them to publish reports about the construction of military railways, the movement of troops, and other kindred matters, statements on such subjects being the exclusive privilege of the official organ of the war minister."

THAT THE PRACTICE of cremation is extending is to be inferred from the numerous references

which are made to new crematories by the daily press of this country and Europe. In France a very important advance has been made, as the prefecture of the Seine has decided to spend $40,000 for a crematorium in the great Parisian cemetery, Père Lachaise. Dr. G. Pini has recently published a book on 'La cremation en Italie à l'étranger de 1774 jusqu'à nos jours,' which shows that in Italy but little progress had been made until the cremation of the body of Albert Keller on the 22d of January, 1876, about which time a society of three hundred was organized at Milan, which published a circular giving urgent reasons for the practice. Thirty-one societies existed at the date of publication of Dr. Pini's work, in the principal cities of Italy, and 894 bodies had been submitted to disposal by fire in the crematories erected by those societies, mainly in Milan, Lodi, Brescia, and Rome. More than three-fourths of this number were cremated at Milan. The chief point worthy of comment in the present law relative to the Society of Milan, is its method of dealing with the only valid objection which has ever been urged against cremation; namely, the possible concealment of crime. The clause in question reads as follows: "If the cause of death is 'incertaine, suspecte, imprévue, ou violente,' the cremation of the body must be preceded by an autopsy." In this country a pamphlet has recently been published by the Worcester, Mass., cremation society, written by Dr. Marble. His argument might fitly be named, as he states, 'The dangers of earth-burial.' He cites many instances to prove that the graveyard is an objectionable institution for sanitary reasons. Chief among the resulting evils he places the pollution of water-supplies. A Massachusetts act was passed in 1885, authorizing the formation of societies for cremating the dead, and contains a provision for the prevention of the concealment of crime similar to that in force in Milan.

RAILROAD TO MERV, BOKHARA, AND SAMARKAND.

WHILE the attention of the world has been engaged upon the Servian-Bulgarian disputes, the Russian engineers have been pushing on the Trans-Caspian railroad, and transforming this mysterious Asia into a Russian province. This road, one of the wonders of our age, which commences at the Caspian Sea, is already opened three hundred and eighty kilometres, to within eighty kilometres of Askabad, and was to be opened to that place in December, 1885.

The grading of the road is finished to Dushak, one hundred and fifty kilometres south-east of Askabad. At this point the road will branch. The Indian branch will be built to Saraks, about two hundred kilometres, where it will connect with the English road from Quetta, through Afghanistan, making the great road to India. The other branch will run north-east into central Asia, crossing the Amu Daria, and running through Bokhara to Samarkand.

This line has been commenced, but it will take at least three years to complete it. It passes through Merv, and will be finished to that place next spring. From the Caspian Sea to Merv is about six hundred kilometres, and thence to the river Amu Daria is about five hundred kilometres.

The road to Dushak crosses a small portion of the Great Desert from the Caspian Sea, about one hundred kilometres, to the great range of mountains that separate Persia from Turkestan, thence along the foot of this range of mountains, through a tolerably well-watered region, to Dushak. Here it crosses the steppes of the Great Desert, towards those broad plains whence Attila, Genghis Khan, and Tamerlane led forth their armies to overrun Europe.

All the materials for the railroad, even the wood for its construction, come from the interior of Russia. Some of the workmen come from beyond Smolensk in Russia, near the borders of Poland; others are the war-like Tekkes and Turkomans, of whom nearly eight thousand have been employed upon the road; while more are seeking employment than are required.

The horses are purchased in the steppes of Kirghiz, one thousand kilometres east from Merv, while their drivers are the Cossacks from the district of the Don, two thousand kilometres west.

Water, which is wanting almost everywhere in these vast steppes, is collected in the oases. It is frequently muddy and sometimes salt, and is then purified by powerful filters, and pumped through pipes, which furnish it to the laborers, thirty kilometres distant. Coal and wood for fuel are wanting; but petroleum has been discovered in almost unlimited quantities, and is used for locomotives and steamers.

The Russian colony lives in ambulant villages, moving along as the work progresses, carrying with it the commissariat, stores, and offices, and a collection of such articles as may be required for the work or the workmen. The telegraph precedes the railroad; and already Merv, Samarkand, and Bokhara are connected by wires with

St. Petersburg, and thus civilization is carried to the oldest of the Aryan tribes.

The Russian merchants are opening warehouses along the line of the railroad, and supplying the inhabitants of the desert on the north, to Khiva, Bokhara, and Samarkand, and the Persians to the south. They have established entrepôts at Merv and Pendjeh, which are already supplying the inhabitants of Herat with Russian manufactures and stores.

In America the locomotive carried with it the emigrants who inhabited and cultivated the land. In Asia the locomotive is retracing the paths which the human race trod in its early days, and carries with it all the wonders that the race has gathered up in its long journeyings. This desert was once the garden of the world; but first wars, and then constant incursions of the Turkomans, have devastated it. The character of the Turkomans we learn from Vambéry, who says in one of his books that they "have the well-deserved reputation of sparing nobody, and would even sell the prophet himself into slavery if he should fall into their hands;" and in another that they have a proverb which says, "If you see a party attacking the house of your father and mother, join them in the plunder and robbery." Now brigandage and slavery have been to a large degree suppressed, and under the Russian rule the old irrigating canals will be re-opened, and this great desert, rich when watered, will be as densely populated as in the early ages. Thus the railroad will become the civilizer of the old world, as it has been of the new. GARDINER G. HUBBARD.

GEOGRAPHICAL NOTES.

Late news from Alaska. — A weekly newspaper, the *Alaskan*, has been started at Sitka. It is a neat quarto, and intended to gather information about the territory, and promote its development. It is the fourth newspaper which has actually been printed in Alaska, though several periodicals treating of Alaskan matters have been issued at San Francisco in past years. The *Alaska times*, a large quarto, edited by T. G. Murphy, appeared in May, 1868, and existed about two years during the military occupation. Some of the numbers were printed on brown paper for want of other material. This was followed in 1875 by a little folio sheet printed on the press of the single military company then left at Sitka, and named the *Alaska bulletin*. About seven fortnightly numbers appeared: and in October, 1876, a similar issue, under the name of the *Sitka post*, was begun, and terminated with its fourteenth number, on the final removal of the troops from Sitka. The present publication is of a more serious character than its predecessors, and the seven numbers which have reached us contain many items of interest which might otherwise have been lost. A weekly summary of the meteorology is furnished by the local signal officer. On the 12th of December, the editor notes that the temperature was stationary at 45° F., and he received a cabbage, cut that week in one of the local gardens, untouched by frost, and of which the solid head measured about fifteen inches in diameter. A canoe express took the weekly issue from Sitka to Juneau in three days, the distance being about 180 miles. A new town, to be called Edwardsville, was going up near the mines on Douglas Island. The Treadwell mine, though somewhat hampered by a scarcity of water, turned out $75,000 in bullion in the last month, and the owners were enlarging its facilities. The Silver Bay mines near Sitka had been taken in hand by a company of capitalists. The oil-works at Killisnoo were running to their utmost capacity, and sent down by the last steamer 300 tons of herring-oil. M. E. Hess, writing from Fort Reliance, says that the natives make portages from that place to the Tananah River in eight days. From the head of the latter to the Copper River they go in from four to seven days. The Tananah heads so near the White River that the Tenan Kutchin Indians cross with their furs, and build a raft, on which they descend the White River to the Yukon, and the latter to Fort Reliance, where they trade, thus drifting about four times the direct distance from their homes to the fort. Mr. Hess had concluded to winter on the White River. He reports gold in placers and in quartz in several places, and also what he supposes to be nickel ore. The prospectors on the Lewis River made from $200 to $500 per man on the bars of that river during the short summer. They report the climate as resembling that of Montana.

The Sakeis of Malay peninsula. — The last annual report of the British resident at Selangore, Malay peninsula, contains some notes on the curious tribe called Sakeis, of whom there are about eight hundred persons. They are divided into nine sections, whose chiefs are called Batins. They live chiefly by collecting rubber and other products of the jungle. They have no formal religion, but are very superstitious, believe in good and bad auguries, consider certain birds sacred, and abandon any settlement where one of them dies. They tattoo the arms by way of ornament, but the tattooing has no tribal or totemic significance. Nothing capable of being eaten comes amiss to them: even scorpions and snakes are acceptable. They kill game by darts, poisoned

with the juice of the upas-tree, projected from a hollow cane, and, for very large game, use a bamboo bow and arrows. They live in bamboo huts about eight feet high, thatched with palm-leaves. They are ugly and timid, but inoffensive. They wear the hair flowing, instead of tied up as the Malays do, and are shorter than the latter, but resemble them in other physical characters. They are gradually becoming accustomed to Europeans; and one or two Malays are attached to each community, on the part of the government, to protect the people from injury or imposition.

The Malpais in Michoacan, Mexico. — Carlos Naulleau has visited the Malpais in Michoacan, Mexico, and from his account we extract the following notes of interest: The Malpais is situated four leagues from Panindicuaro, and is a region four leagues long and two wide, covered with fantastic emissions of a now extinct volcano. The pinnacles and blocks resemble a ruined city, and are so rough and angular that one would need steel armor to make one's way among them unwounded. There are many caverns, natural pits, and shafts to be avoided. The scene is extraordinary: the twisted and sombre rocks are destitute of the smallest sign of vegetation. It is said that in this retreat the ancient Indians fortified themselves against Cortes and his followers. The place is a natural citadel, within which, it is asserted, the aborigines built themselves a town surrounded by a triple wall with only one entrance. One legend states that thousands found a refuge here, and that the place was twice visited by a pestilence, the second time only sixty persons escaping to Zacapu. There, in the library of the Franciscan fathers, the Rev. Fermin Martinez, who has given the subject much study, has found some records relating to the fugitives. Among the higher parts of the confused masses of lava are several structures formed like teocallis, surrounded with a narrow stairway, and connected with each other by paths made of blocks of lava. There are also several ruined houses in different places. The most remarkable teocalli measures at the base thirty-five by twelve varas, and is fifteen varas high. It has been excavated for antiquities. At a depth of three or four varas were found several small cells built of adobe, each containing a skeleton with a small jar of pottery, many arrowheads, and a few knives made of obsidian. The investigations were interrupted by banditti, who doubtless supposed that treasures of gold or jewels were being secured by the diggers.

Return of Aubry. — Aubry, who for two years and a half has been travelling in Shoa, Galla- and Somali-land, on a mission from the Ministry of public instruction, has safely returned to Paris. His companion, Dr. Hamon, succumbed to fever on the eve of his return, and died by the Hawash River, between the Abyssinian mountains and the Gulf of Aden. Aubry was obliged to fight to escape the Somalis. In the confusion his collections of zoölogy and botany were lost; the mineralogical and geological collections, however, were saved, as well as all his note-books, maps, etc. The results of his work will soon be made public.

ASTRONOMICAL NOTES.

Comet 1885 V (Brooks). — We learn from Mr. Barnard of the Vanderbilt observatory, Nashville, Tenn., that he found this comet independently on the evening of Dec. 27, 1885, and telegraphed immediately to Swift his discovery, receiving in reply the announcement that he had been anticipated one day by Brooks. Mr. Barnard had resigned on the 30th of August, 1885, the zone (+ 15° to − 45°) originally allotted to him, and carefully watched since 1882; and it was only in casually devoting a few hours to the field in which he has been so successful that he picked up the new comet. An orbit computed by Chandler and Wendell shows that the comet is decreasing in brightness, having passed perihelion on Nov. 29, 1885.

The Lick observatory. — Professor Holden has written an interesting article for the *Overland monthly*, sketching the history of the observatory to the time of his taking charge. In regard to the immediate inception of astronomical work, he says, "It is of the first importance to find some means of paying the salaries of one or two observers for the years 1886 and 1887, in order that the magnificent equipment may be at once put to its legitimate uses. No great sum is required, but a few thousand dollars at this time would be of real service." It is stated that the first volume of publications of the 'Lick observatory of the University of California' is now in course of preparation, under the direction of the Lick trustees, by Capt. Richard S. Floyd and Professor Holden.

NOTES AND NEWS.

WE take the following from Governor Robinson's message to the Massachusetts legislature: "Although no legislation seems to be needed upon this subject [topographical survey], it will not be inappropriate to emphasize the importance of the work, and to commend its successful prosecution under the direction of the state commissioners, acting in co-operation with the U. S. geological survey. During the year 1885 about two

thousand five hundred square miles, nearly one-third of the area of the state, have been covered. The cost of the field-work will very nearly correspond with the original estimate of ten dollars per square mile. Of the $15,000 appropriated last year, the sum of $12,750, or about $5.14 per square mile, has been expended. The United States has also made an outlay, by the coast and geodetic survey, in behalf of the commonwealth, of nearly $1,300 in the triangulation of the valley of the Connecticut River. This sum has been supplemented by $470.47 out of the state appropriation, in the determination of the boundary-lines of cities and towns, for which the triangulation is the basis. The city and town boundary survey has been commenced in the counties of Suffolk, Norfolk, Plymouth, and Bristol; and it is expected that the work will be continued, and extended into other counties, during the current year, with all practicable despatch. I commend to your favorable consideration the reasonable requirements of the commission, in order that you may provide the means to meet the necessary outlay."

— The long voyage of the derelict schooner 'Twenty-one friends,' as reported on the latest 'Pilot chart,' now extends from March 24, off Hatteras, to Dec. 4, when it was entering the Bay of Biscay, twenty-three observations having been made on it during the drifting passage.

— The *American* (Philadelphia) of Jan. 2 contains a readable article of a page on 'The New Jersey shore,' describing briefly its mild climatic features, which make it valuable as a winter sanitarium as well as a summer resort. Some account is given of the different types of beach which make up the coast there, and of the island near Cape May known as Five-mile beach. Here a neglected herd of cattle ran wild several years, and survived the winters, unprotected and unfed, except in the coppice and holly groves: the latter are remarkably fine on this island. The bays of Barnegat and Little Egg harbor are described as sunken meadows traversed by a network of submerged channels, and enclosed from the sea by long strips of sand beach and dunes.

— The prizes awarded at the annual meeting of the French academy, on the 21st of December, were as follows. Geometry: for general studies on the problems of excavation and embankment, divided between Mr. Appell and Mr. Otto Ohnesorge; to Mr. Emile Barbier the Francoeur prize. Mechanics: the grand prize of six thousand francs, for the progress of efficiency in naval forces, was divided among Messrs. Hélie and Hugoniot, for their treatise on experimental ballistics; Mr. Ph. Hatt, for his 'Suggestions on marine phenomena;' Mr. Lucy, for his geographical index; and Mr. Doneaud du Plan, for various works. Other prizes were given to Mr. Henri Poincaré, for his mathematical works; Mr. Amsler-Laffon, for his construction of the instrument called the 'polar planimeter;' Mr. Bienaymé, for a work on the steam-engine; Mr. Daymard, for researches on the calculation and graphical representation of ships; Mr. Felix Lucas; and to Mr. Jean-Daniel Colladon, the Fourneyron prize, increased to the value of three thousand francs, for his 'Theoretical and practical study of hydraulic accumulators, and their applications.' Astronomy: to Mr. Thollon, for his chart of the solar spectrum; and to Dr. Spoerer, for his work on sun-spots. Physics: the Bordon prize, for researches on the origin of atmospheric electricity, to Mr. Edlund; and the Lacaze prize to Mr. Gernez, for various studies in chemical physics. Statistics: the Montyon prize was divided equally between Dr. P. de Pietra-Santa, for his 'Contributions to the study of typhoid-fever in Paris;' and Mr. O. Keller, for his statistics of mineral industry, etc. Chemistry: to Mr. Prunier, for his researches on the carburets of the American petroleums, etc.; and Messrs. R. D. Silva, G. Rousseau, and Prof. A. Ditte, for various researches. Geology: to Mr. de Lapparent, for his memoir on the country of Bray; and Mr. Alfred Caraven-Cachin, for his 'Geographical and geological sketch of the department of the Tarn.' Botany: to Messrs. Dubois, Heckel, and Schlagdenhauffen, for various researches; to Leclerc du Sablon, for his researches on the hepaticae; and to Mr. Patouillard, for his work on fungi. Anatomy and zoölogy: the grand prize to Dr. Joannès Chatin, for his unpublished work entitled 'Researches on the tactile organs of insects and crustaceans;' and to Mr. Paul Girod, for his studies on the cephalopods. Physiology: to Mr. Duclaux and Mr. Remy, — the latter for his nerve studies. Medicine and surgery: to Dr. L. H. Farabeuf, for a treatise on manual operations; Dr. Augustin Charpentier, for memoirs on the function of the retina; J. Regnauld and E. Villejean, for researches on the anaesthetic properties of formines, and their chloric derivatives; to Dr. E. Gavoy, for invention of the instrument named 'cerebrotome;' to Mr. P. Redard, for his works on military transportation of the sick, and medical thermometry; to Dr. Paul Topinard, for his anthropological works; to Dr. Mahé, for memoirs on the cholera; to Drs. L. Bouveret, Gabriel Pouchet, Émile Rivière, and A. Villiers, for various cholera studies; to Dr. Ernest Desnos, for 'Studies of a particular cause of urinary retention;' to Dr. Grasset, for a 'Practical treatise on the diseases of the nervous system.'

Other prizes were awarded to Mr. Ch. Girard, for various physical and chemical works; Mr. Van Beneden, for researches on the development of the lower animals; Mr. Bourbouze (photography); Mr. Sidot (chemistry); Mr. Valson; Mr. G. H. Halphen (mathematics); and Mr. Sappey, for his work entitled 'Anatomy, physiology, and pathology of the lymphatic vessels, considered in man and other vertebrates.'

— Letters had been received at Vienna, Dec. 29, from Professor Lenz, of the Austro-Hungarian Kongo expedition, dated Ango-Ango, Oct. 31. He announces his departure for Stanley Pool, his assistant, Dr. Baumann, having succeeded in obtaining at Nyombi 80 natives as porters. It is difficult to secure these auxiliaries. The French missionaries, who are also travelling up the Kongo, meet with even greater difficulties, their porters having run away. A similar misfortune has happened to the German expedition under Lieutenants Knuth and Tappenbeck. The health of the members of the Austro-Hungarian expedition is satisfactory, although the transition from the dry to the rainy season is very dangerous to Europeans.

— Why Labberton's 'Historical atlas' (New York, *Townsend, MacCoun*) should have reached an 'eighth edition,' is one of the mysteries of book-publishing in this country. The maps, many of them, are of the rudest description. In fact, so bad is the workmanship, that in some cases important cities are laid down miles away from their actual sites. Nor is the selection much better. There are sixteen maps of Britain, no less than twelve of which relate to a period anterior to the reign of King Aelfrid. The last of the set is a map showing the Norman conquest. Of England since 1071, nothing is given except a few miserable maps in the corners of the maps of Europe. The Puritan revolution is utterly ignored. The 'explanatory text,' so loudly announced on the titlepage, adds little to the worth of the book, while 'the carefully selected' bibliography can appear of value to those only who are ignorant of the literature of the subject. The maps showing the growth of our own country are based on such an inadequate knowledge of our history that they are little more than a mass of error. In fine, although the plan of the atlas is good, the selection and workmanship are so poor, that we lay it down as one of the most unsatisfactory books of the past year. Much better in every respect is the 'Standard classic atlas,' bearing the following imprint: "Copyright, 1885, by Ivison, Blakeman, Taylor & Co., publishers, New York and Chicago." The maps are well drawn, and admirably chosen. In fact, we were just beginning to congratulate ourselves on the advance which American map-makers had made during the last few years, when suddenly our attention was drawn to the following words, attached to map 18: "Engraved by Becker's patent on steel, Stationer's Court, London." So, after all, this is an English book which in some way or other these publishers have copyrighted. If such actions are legal, what need have we for an international copyright law? As to the book itself, it is a good one, and contains besides the maps a very useful alphabetical index, giving the position of about ten thousand places, with their ancient and modern names.

— To judge from the statements made in the introduction to a treatise on 'A system of iron railroad-bridges for Japan,' by J. A. L. Waddell, published by the University of Tokio, many of the iron bridges erected by foreign contractors, and now in use in Japan, are of inferior construction. Professor Waddell, who occupies the chair of civil engineering at the University of Tokio, has here aimed to make clear to Japanese engineers the method of designing the class of structures mentioned, and he has covered the ground in an extremely satisfactory manner, and with much minuteness of detail. The book must prove a great benefit to Japan by securing improved construction, and there is much in it that will be serviceable and suggestive to American engineers, even if they should not agree entirely with him in the discussion; for his devices and methods are not always those which are commonly employed in the United States. He analyzes in all its parts the American type of bridge as adapted to the conditions of the Japanese narrow-gauge railroads. He gives tables and strain-sheets, the preparation of which must have required a vast amount of labor, and which by themselves make a large atlas. Some portions of the memoir have appeared in this country as papers submitted to different technical societies. It is a most agreeable surprise to find that the University of Tokio endeavors to extend its usefulness by publishing treatises of so eminently practical a character.

WASHINGTON LETTER.

SCIENCE and the scientific have in some degree indulged in that suspension of activity which is the recognized privilege of the more serious occupations during the holiday season. Some of the societies have suspended their meetings for a period of two or three weeks. When they are resumed, the season's work will begin in earnest, as it is said that papers of considerable importance, growing out of the field-work of last summer, are nearly

ready for public presentation. The president of the National academy has spent a part of the vacation time in the city, largely on business connected with the affairs of the academy. The visit is timely, as it doubtless has enabled Professor Marsh, on various occasions, to express his views, and to some extent the views of the academy, on several questions of primary interest and importance to science and scientific men, which are just now coming before the national legislature.

Of these, one of the earliest to be brought forward is the proposition to establish a national university in accordance with the provisions of a bill introduced by Mr. Ingalls in the senate at its first session after the holidays. The idea of such an establishment is as old as the government itself, and it is said to have been recommended by every president from George Washington down, with the possible exception of Lincoln, whose time was so occupied with matters of greater moment and more immediate importance as to preclude its consideration. The bill was ordered printed and to lie on the table. It is said that senator Ingalls intends to make an argument in its favor in the near future. The measure will unquestionably have warm friends and strong opponents.

A leading member of the senate recently remarked that experience had convinced him that an appropriation of fifteen hundred dollars was sufficient to start a national university, and cited in proof that some of the scientific branches of the government now expending nearly a million dollars annually, were inaugurated with appropriations of one or two thousand dollars.

The subject of an international copyright law is likely to receive attention from congress at an early date. It was before the senate judiciary committee in the last congress, but in the early part of the present session it was referred to the committee on patents. It is said to be the intention of this committee to give the subject a thorough consideration, and that prominent exponents of both sides have been invited to express their views and arguments. The list includes many prominent American authors.

An experiment in the direction of securing communication between vessels at sea by means of electricity will be made at some time during the present week in the Chesapeake Bay. A board of naval officers, consisting of Commander Hoff and Lieutenants Reeder and Meigs, has been detailed to witness the trial. They will be accompanied by Prof. A. Graham Bell, who has long been interested in the subject, and who has himself experimented upon it.

The improvement of signalling by methods other than electric has for some time been under consideration, both in the army and the navy. A committee has been selected, consisting of General Hazen of the army, and Commander Hoff and Lieutenant Reeder of the navy, to report upon a more desirable code of signals for the service of the United States. It has been agreed to instruct a certain number of men in each of the codes used by the different governments of the world, and by a sort of competitive examination to determine which is the best. Improvements are also being made in heliographic signalling. Experiments at long range with various forms of apparatus are about to be undertaken under the direction of Lieutenant Purssell, in charge of the division of military signalling of the signal corps.

Although this system of signalling has come into almost universal use, there does not seem to have been any very decided advance in methods since the successful experiments of Moses G. Farmer in 1861. The signals are made by long and short exposures of light, to which system the dot and dash alphabet of Morse is easily applicable. At long distances, however, and under unfavorable atmospheric conditions, it becomes difficult to distinguish the long from the short, and a limit to the rapidity of transmission is soon reached. Lieutenant Finley of the signal corps has recently constructed a heliograph in which two mirrors, or two sources of light, are used, separated far enough to be readily distinguished by the reader of the message. The display of one of these only, means a dot, while the exposure of both at the same instant means a dash. This method promises to increase both the certainty and rapidity with which the message can be read; but its great advantage is that a vastly less amount of skill and training will be required in its working, on account of the nearly complete elimination of the comparison of time intervals.

In spite of the many attractions which Washington offers to the scientific worker, it now and then happens that the resultant of all the forces is in an opposite direction. There is more or less that is disagreeable incident to all government work, and unfortunately there is a more or less uncertain tenure of office, so that occasionally a college corporation carries off a man whose services the government ought not to lose. A recent example is that of Professor Gooch of the geological survey, who will leave his post here to become professor of chemistry in Yale college.

One or two other attempts of a similar character have been made within a few months; but the facilities for original research in certain directions, which are offered here, have prevented their being successful.

Z.

Washington, D.C., Jan. 11.

LONDON LETTER.

THE application to the treasury, on behalf of the Marine biological association, to which reference was made in a former letter, has been very successful. An intimation has been received by the council that their lordships propose to submit to the house of commons an estimate which will grant to the association the sum of five thousand pounds, to be paid in two annual instalments, together with a yearly subscription of five hundred pounds for five years afterwards. This is as it should be, and the conditions imposed are practically nominal, as they entirely coincide with the intentions of the council. The accounts are to be formally audited, and afterward published; assistance is to be given to the solution of the economic questions connected with the British fisheries; and accommodation is to be afforded to investigators who may desire to work out definite problems of marine zoölogy. A resident superintendent has been found in the person of Mr. Walter Heape, who will enter upon his duties with the new year, and in preparation for them has already visited the chief American institutions of the same kind. He is well known as an embryologist, and has recently received the honorary degree of M. A. from the University of Cambridge, for his services as demonstrator of animal morphology. Having been brought up to a business life which promised to be one of considerable success, he deliberately relinquished it in order to devote himself to scientific pursuits; and in 1879 he was attracted to Cambridge by the high reputation of Mr. F. M. Balfour, who died three years later. But the impulse which Balfour had given to the study of morphology in the university was well sustained by his senior pupils, Sedgwick, Welldon, and Heape; the latter of whom will now have the opportunity, in the new laboratory at Plymouth, of doing very much to advance his favorite sciences of morphology and embryology.

A very interesting exhibition of the appliances used in geographical education has been recently opened under the supervision of the Royal geographical society. About eighteen months ago, Mr. J. S. Keltie (sub-editor of *Nature*) was appointed by the council of the society as an inspector of geographical education for the purpose of obtaining information respecting its position and methods by personal investigation, both in the United Kingdom and on the continent of Europe, and by correspondence as regards America. He has published an elaborate report, which has been recently issued as one of the society's supplementary papers; and the collection which he made of the various appliances used in geographical education is now on view. The exhibits are classed as follows: 1. Wall-maps; 2. Globes; 3. Telluria, planetaria, etc.; 4. Models and relief-maps; 5. Geographical pictures; 6. Atlases; 7. Text-books; 8. Miscellaneous. The collection is one of great interest, though, as Mr. Keltie says, "it contains specimens of all gradations of quality. In all classes will be found objects which may be taken as examples of 'how not to do it.'" It is hoped that many schoolmasters may be induced to visit the exhibition during the Christmas holidays, and a series of conferences on the subject of geographical education has been arranged. Many eminent men at both the older universities are desirous of seeing geography formally introduced as a branch of scientific study. The appointment of a university teacher in the subject was suggested at Cambridge some time ago, and it is rumored that a similar step will soon be actually taken at Oxford. Should this prove to be the case, there can be no doubt that it would have a powerful influence in improving the position of geography in the public schools, where it receives, as a rule, from one to two hours weekly of more or less perfunctory teaching at the hands of men who have no special interest in their work, even if they are not absolutely opposed to it from its taking up time which they would like to see devoted to classics. At King's college, London, Prof. H. G. Seeley, F.R.S., is professor of geography.

The fact of the comparatively slow adoption of the electric light in England has already been mentioned in these letters, although the reasons thereof may not have been. The chief reason is to be found in the restrictions upon the development of the industry laid down by the electric lighting act of 1882. Until these are relaxed, no commercial company can light a district with any chance of financial success, owing mainly to what are known as the 'compulsory purchase clauses.' Within the last few days an official programme of legislation for next session has been put forward, and among the measures there named is a new electric lighting bill. The political prospect, however, is so disturbed, that the chances of any such domestic measure becoming law this session are very small.

In connection with this subject, it may be mentioned that there are well-founded rumors of a new form of battery, suitable for electric lighting, to which the inventors give the name 'primary' battery, but which is really a modification of the ordinary 'secondary' battery, for which it is claimed that its yield in ampère hours, per pound of lead, far exceeds any thing yet accomplished. Cells prepared in England have

been subjected to very severe tests in Paris by M. Hospitalier and other well-known electricians.

The 'juvenile lectures' at the Royal institution, first rendered popular by Faraday in his 'Chemistry of a candle,' are this year being given by Professor Dewar, who has chosen 'The story of a meteorite' as his subject.

The Corporation of Liverpool has just issued the programme of its twenty-first winter course of lectures, to be given in the rotunda lecture-hall of the Free public library. These lectures are paid for by the corporation, and admission thereto is absolutely free. The hall holds about sixteen hundred, and is usually well filled by the 'great unwashed' of Liverpool, on Monday, Tuesday, Wednesday, and Thursday of each week from Jan. 4 to March 11. The first lecture is by Mr. William Lant Carpenter, on 'Temperature and life in the depths of the sea.' Prof. Oliver Lodge, whose lecture on 'Dust' in Montreal will be remembered, and several of his colleagues in University college, Liverpool, as well as some of the professors in Stonyhurst college, are among the lecturers. It is greatly to be wished that other towns, on both sides of the Atlantic, would follow the example thus set. W.

London, Dec. 23.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Eskimo building-snow.

I ENCLOSE a photograph, kindly sent me by General Loring, of the Boston Museum of fine arts, of snow impacted on a telegraph-pole, by a strong gale, near the summit of Mount Washington. It furnishes a good example, near home, of the texture of snow, under the influence of a fierce wind and intense cold, and will make clear some remarks I have previously made in your journal regarding the use of snow by the Eskimo among whom I travelled. In my description of the igloo (snow-house) of the Innuit in *Science* during the summer of 1883, I mentioned that the first snows that fall are not used by the Eskimo of my acquaintance to build snow-houses, the preliminary igloos being of ice for three or four weeks, until the deep drifts of snow had been subjected to very low temperatures and the 'packing' influences of strong winds. The winter weather of the summit of Mount Washington is in most respects essentially arctic.

In the accompanying illustration we see readily the peculiar texture or strong 'binding' power of the snow under those conditions of wind and cold, and it is now in a condition for an igloo snow-block. It is readily seen that it must have great cohesion to hold up such a heavy load on such a fragile support.

The cohesion of snow in our latitudes (and the early snow of the Arctic) is of a plastic, wet, or 'pasty' character, as shown in the making of snowballs, the formation of huge balls of snow on the ground as they roll along, snowmen, balling on horses' feet, etc. (also shown by Mr. Williams's letter in *Science* of March 6, 1885; Mr. Stone's letter of May 29, 1885, in *Science;* and others to you). This is essentially unfit for snow-building.

The snow fit for igloos is of a dry, almost stone-like character. The cutting of a thin portion from the side of an arctic snow-block, instead of giving a sheet of plastic snow as from a snowball, produces a shower of fine powder, exactly the same as from a large lump of loaf-sugar. In short, the arctic building snow-block stands in about the same relation to those we would make here, as the brick just from the mould, and before it is dried, bears to the same object when burnt in the kiln, and ready for use. The arctic snow-blocks ring like a well-burnt brick; and this is especially noticeable during intensely cold weather,

HARDENED SNOW ON A MOUNT WASHINGTON TELEGRAPH-POLE.

when I have heard a snow-block, as it was struck with a knife, give forth a clear, metallic, musical sound, not unlike the striking of a highly tempered bar of suspended steel with the hand, or other non-metallic substance.

I remember, when my natives were building a snow-house on the high 'divide' between Back's Great Fish River and Hudson's Bay, the thermometer in the minus 60's, a block of snow rolled down the hill for fifteen or twenty feet, and I doubt if a rolling guitar would have given forth many more confused musical tones than the bumping block as it struck and bounded along down the hard, stone-like bank of snow.

Yet it must not be inferred that this dry, compact snow has any of the characteristics of ice about it. It is not only much lighter than ice, but, I believe, lighter than the plastic snow we have, certainly not so dense as when made into the ordinary snowball. In fact, the least quantity of ice in the snow — which sometimes happens — renders it more or less worthless for building, according to the amount. In the late spring, banks of snow having southern exposures, and thawing slightly about noon, only to

freeze again, and others subject to drainage (and a few other causes), often have ice permeating the mass, sometimes in little fine needles, which make the mass worthless, and now and then in little crystals scattered through it. If these crystals are much larger than a pea, and more numerous than one to about every four square inches exposed by a section, the bank is rejected by the Eskimo snow-builder, unless others cannot be found.

The packing of the wind and low temperature are needed to produce the true building-snow, and, in the absence of either one of these conditions, the action of the other seems to be worthless. As to temperature, this is shown by the snow not being good, as judged by the Eskimo, until it is *ik-kee-oo-ad-lo* (very cold) despite the fiercest gales having occurred. It is shown as to the wind by not finding good building material in deep gorges, and other places where the wind cannot get at the snow to pack it down, long after it is perfect in other localities. My information on these points did not come from such observations, however, but directly from Eskimo explanations, and I add these to corroborate them. I do not believe—although I do not positively know—that both wind and low temperature must come together, but both must have happened before the Eskimo will use the snow for building, though possibly the two may be independent in time. When I say the Eskimo will not use it, I mean as a usual thing and in a general way; for in his cheerless country he is often driven to dire expedients, and does many things under a sort of polar protest.

After my detailed description of an Eskimo snow-house in *Science*, and some popular accounts in other periodicals, I learned in several ways (by correspondence and from accounts given me by the editor of *St. Nicholas*) of attempts to reproduce these domiciles in our country having ended in failure. Of course, the main reason of such failures was in the lack of knowledge to construct the igloo, the manual dexterity needed, it being an art which requires no small amount of the early life of an Eskimo to acquire to that perfection we often see among them; yet the builders who failed in their undertakings may console themselves with the fact that it is only in rare cases that the snow will be of the right texture in so low a latitude. The alpine districts, as Mount Washington in the winter, and similar places, might do. Ebierbing (Eskimo Joe, as he was known in the United States), my interpreter, told me that he had built a few igloos in the United States for the edification of curious crowds, but he was only too glad not to see them tumble in and ruin his reputation as well as the house; but, as to living in them, he would never have thought of it.

FRED'K SCHWATKA.

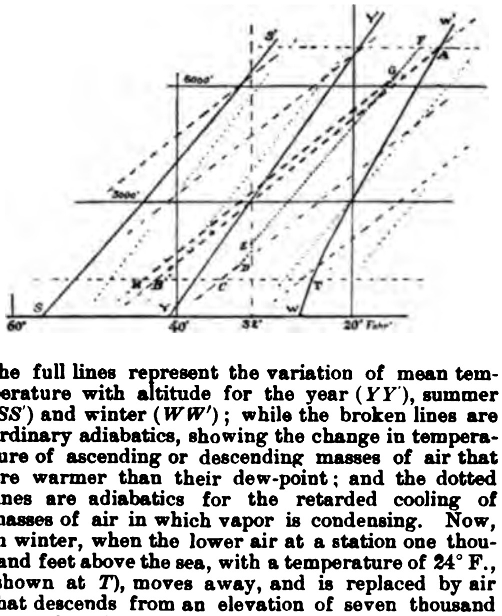
New York City.

'Chinook winds.'

Dr. Dawson's interesting note on the Chinook winds of the north-west does not fully represent the views on the origin of the *foehn* held by Dr. Hann.

The *foehn* winds, and presumably the Chinook also, are often felt on the leeward side of a range before any rain falls on the windward side: therefore, while the evolution of latent heat by condensing vapor is a true and important cause of the warmth of the *foehn* in the manner indicated by Dr. Dawson, it is not the first or the only cause, and I think it is not the most efficient cause. Dr. Hann has shown that the first cause of the warmth is the descent of air from the level of the passes and peaks in response to the needs of a low-pressure area on the leeward side of the range; and, as the temperature of the upper air is not greatly lower than that of the surface air in winter (the vertical decrease of temperature in the atmosphere being slow in this season), the descent of the upper air gives it a warmth and dryness that is very abnormal. The *foehn* is indeed, like our north-east winds, a current that is propagated backwards; first, the air is withdrawn from the plains in front of the mountains by the approach of a low-pressure area; then the air in the valleys flows out over the plains; next the upper air descends from the passes into the valleys, warming as it falls; finally the air rises on the farther side of the range, clouds form in it, rain falls from it, and it therefore cools slowly in its ascent; but, as soon as the little cloud that crosses the range is dissolved, the air warms rapidly in its descent; and thus the *foehn* is established. Doubtless the last two processes go on together.

I have used the accompanying figure (based on a diagram by Hertz) to illustrate the *foehn* problem:



the full lines represent the variation of mean temperature with altitude for the year (YY'), summer (SS') and winter (WW'); while the broken lines are ordinary adiabatics, showing the change in temperature of ascending or descending masses of air that are warmer than their dew-point; and the dotted lines are adiabatics for the retarded cooling of masses of air in which vapor is condensing. Now, in winter, when the lower air at a station one thousand feet above the sea, with a temperature of 24° F., (shown at T), moves away, and is replaced by air that descends from an elevation of seven thousand feet, where its temperature is 10° (A), the latter will reach the ground (B) with a temperature about 42°, and a very low relative humidity: it is almost twenty degrees warmer than the air whose place it has taken. The descent must be rapid, or else the air will be much cooled on approaching the cold ground.

A second example shows the action of rain: starting on the farther side of the mountains, with a temperature of 35°, suppose the air ascend five hundred feet from C to D before any condensation takes place; then, clouds forming and rain falling, further cooling is slow, as shown by the steeper dotted line, DF. Where this line crosses the temperature of 32°, there will be a brief ascent without any cooling, until all the cloud-particles are frozen: this is shown by a short vertical turn at E, but the effect is small.

Supposing the air rises to one thousand feet, it will there be cooled to 12°; then descending, as it passes over the range, it will at first (*FG*) warm as slowly as it cooled, until all the cloud that it carries is dissolved; the rest of the descent has a faster warming (*GH*), and the ground is reached with a temperature of about 43°, or 8° warmer than when the ascent began.

These figures are not precise, as the diagram is rather hastily constructed from Hertz's plate; but they serve to show how much greater a change is produced by the descent of the upper air than by the evolution of latent heat in a transmontane wind. The approach of the line of summer temperature (*SS'*) to parallelism with the adiabatics also illustrates how much fainter the *foehn* must be in summer than in winter.

The following quotation from Espy's 'Fourth meteorological report' (1857) is of interest in this connection: "It is known that air, in passing over high mountains, . . . is twenty or thirty degrees warmer than the atmosphere is at the same height over plains, because in passing over them it has the latent caloric in it, just evolved by the condensation of the vapor on the windward side." "Air can never come down from a great height without being very dry when it reaches the surface of the earth." "At the time of this hot south wind, there may be a great rain taking place on the other side of a mountain to the south of the observer, sending its hot air over above, and radiating its abnormal heat down, and even bringing some of the hot air down the slope on the north, which would be felt there as an excessively hot, dry air." He also quotes Lepoy's mention of a warm south-west wind at Fort Simpson, east of the Rocky Mountains in British America, and applies the above explanation to it (pp. 146, 147, 151).

W. M. DAVIS.

Cambridge, Jan. 12.

The claimed wheat and rye hybrid.

There is very slight botanical distinction between the wheat and rye genera, and hence we could scarcely select two genera between which we should more readily expect, *a priori*, a success in hybridization. The question, however, is, Has such a hybridization been effected? Mr. Charles Barnard, who scarcely can speak as a botanist, states in the January *Century*, p. 477, that it has taken place. As one who has carefully studied the published claims, and who has also visited the growing plants upon which the result is claimed, I must beg to dissent. Without opportunity for a careful and thorough examination of the various plants produced, I dare not affirm that such a hybridization has not been effected; yet I do dare affirm that the evidence adduced is insufficient to establish the fact, and is sufficient to establish grave doubts.

What are the facts? The flowers of the Armstrong wheat were treated with pollen from rye. A number of variables were produced from the resulting seed, which, without careful botanical investigation, have been pronounced hybrids. These figures were published in the *Rural New-Yorker* of Aug. 30, 1884.

Lindley distinguishes rye from wheat by its narrow glumes, and constantly twin narrow florets with a membranous abortion between them. In the drawings referred to, the glumes in all the figures are drawn broader than in the rye. In four of the figures the spikelets are distinctly those of a common wheat. In the fifth figure — the one called by Mr. Carman "a distinct grain, neither wheat nor rye, and as different from either as wheat is from rye, or rye from wheat"— we must look for the hybrid, if at all. This plant, so far as can be indistinctly made out from the figure, has its spikelet solitary on each notch of the axis, with two nearly equal glumes; and the outer pale of each floret has at the top either a notch or angle on each side of the terminal point or awn, — all the distinguishing characters of the genus Triticum. It has not the narrow glumes nor the constantly twin narrow florets which are peculiar to rye.

What do these figures resemble, if not rye? Judging by comparison of pictures, his No. 335 is close to the Froment de Saumur; his No. 336, to Froment Pictet; his No. 337, to Froment de Naples; his No. 338, to Froment blanc de Flandre; his No. 339, the supposed hybrid, to Froment de Pologne compact, — all, as figured by Heuze, in the form of the head. I do not mean to say by this that they are these varieties, for the material for judgment does not admit of such close comparison; but I refer to these varieties, and those represented by Mr. Carman's figures, as representing like types of head.

We do not question the attempt at a cross. The variability effected is indication of the influence of a foreign pollen. We can explain the appearances, however, by an hypothesis. Under the stimulus of the rye pollen, atavism has resulted, whereby varieties dormant in the Armstrong wheat have made their appearance; and to those unfamiliar with foreign varieties, whose type appears in the progeny, the seedlings produced seem as if novelties, the unfamiliar Blé de Poland being little known in this country.

The whole subject is, however, too interesting a one to allow to pass without comment such statements as the *Century* article contains, and it is to be hoped that at some time a botanist expert in agricultural botany may have opportunity to investigate a series of these specimens.

E. LEWIS STURTEVANT.

Geneva, N.Y., Jan. 6.

Stepniak's 'Russia under the tzars.'

Will you kindly permit a few words of reply from one of your English readers to M. Woeikof's letter on p. 478 of your issue for Nov. 27, 1885?

We in the old country, who are watching with deep interest the struggle for freedom now going on in Russia, do not attach so much importance as your correspondent seems to think we should, to Stepniak's personal share in the conflict: indeed, we do not even care to inquire about it. The important point for us is the accuracy of the facts he has brought forward. If true, they place the Russian government outside the pale of civilization, and deprive it of all right to appeal to civilized Europe against any act in which the wrath and despair of its subjects may find vent. If false, they can easily be disproved. Stepniak has plainly stated names, dates, and sources of information; his book has now been for a year before the public; and he has reiterated his charges through the leading organ of the English press. If the Russian government is maligned, why does it take no steps to disprove his statements?

But whilst Stepniak's allegations are confirmed by

the most reliable sources of information at our command, they are only challenged by such bitter personalities and trifling evasions as those indulged in by your correspondent. Writing with evident animus, he can find nothing better to object to Stepniak's crushing indictment against the whole system of government in his country than a quibble as to whether a man who escapes from the prison hospital can be said to escape from prison (your readers will find a detailed account of Prince Peter Kropotkin's escape in Stepniak's 'Underground Russia'); and the obvious truism that polite circles at St. Petersburg profess ignorance of cruelties, their master desires to conceal.

Until some better evidence to the contrary than this is laid before us, we English lovers of liberty must consider the case against Russian despotism as proved; and we shall endeavor — not in hatred, but in love, toward the Russian people — to aid them by every means in our power in their heroic efforts to free themselves and their country. C. M. Wilson.

London, Dec. 27.

Ruminants of the Copper-River region, Alaska.

While on the Copper or Atnah River of Alaska, and its principal tributary the Chitina (*Chitty*, copper; *na*, river), I had occasion to learn something of the species of ruminants inhabiting the region. Of the Cervidae, only two species, as far as I had occasion to learn, exist; viz., the moose, Alces machlis, called by the natives tenáyga; and a form of the caribou, Rangifer tarandus, called by the natives honnái.

Of the Bovidae, there were two species, one of which, called by the natives tebáy, I had occasion to carefully examine. It nearly resembled Dall's mountain sheep (Ovis canadensis Dalli, Nelson), "found in the mountains of Alaska and southward into British America." My party killed several of these animals, one of which, a ram, had horns twenty inches long and nearly straight. It was killed on a very high point, much above the timber-line, and in its fall was considerably crushed. The horns were similar in structure to those of the big-horn, but had very little curvature. I saw a spoon made from a tebáy's horn, which had a length of twenty-six inches, and measured five inches across the bowl. The natives informed me that some had much larger horns than the one that furnished material for this spoon. This may or may not be true.

The head of the tebáy was much like that of a Southdown ram, the muzzle much less sharp than that of Shaw's Ovis canadensis or Nelson's Ovis canadensis Dalli. The hair, as to kind, was in no respect different from that of the latter animal, but was of a uniform white color, and by no means dirty; in fact, was nearly as white as his surroundings of snow. From the best information obtainable, I would class it as an equal in size to the big-horn, and a relative of Dall's mountain sheep. The ram and one other tebáy were killed on the most northerly tributary of the Chitina, called by us Chitistone (Copper-stone) River, on account of the existence there of copper ore.

The natives informed us that a few miles below the junction of this tributary with the Chitina we could kill small tebáy, and four were obtained. Their heads were left on the mountains, but the body seemed identical with that of the Chitistone River specimens, though very much smaller. Why only small ones should be found at this place, in the latter part of April, I cannot say. The mountains here were not so high as farther to the east and north, where the large ones had been killed. The last tebáy seen or heard of by us were near the source of Copper River, on the divide between it and the Tananá River.

The other species of the family was a white animal whose pelt I frequently saw used in articles of wearing-apparel, and which, from its description, was probably the mountain goat, Mazama montana, found also on the head waters of the Yukon River and its upper tributaries. I saw some of these animals at the junction of the Copper and Chitina rivers, on the west banks of the former, but was unable to obtain them.

H. T. Allen,
Lieut. 2d cavalry, U.S.A.

Washington, Jan. 2.

The festoon cloud.

In the *Philosophical magazine* for July, 1857, Mr. W. S. Jevons, then assayer at the Sydney branch of the royal mint, had an article on the cirrous form of cloud (vol. xiv. 22–35), and gave therein the best early account that I have met with of a peculiar form of cloud, since commonly called the 'festoon' or 'pocky' cloud. He says these forms are often to be seen on the under surface of dense cirro-stratus clouds, 'especially at the front or tail of a thunder-cloud.' Sometimes these dropping portions of cloud, or 'droplets,' as he calls them, seem to come into contact with dry air, when their well-defined form is destroyed, and a fibrous or fur-like appearance only remains. 'They appear to be truly portions of subsiding cloud.' An accompanying 'imaginary section of a thunder-cloud near Sydney' nicely illustrates their attitude, but not their form.

The earliest valuable figure of the festoon cloud is presented in an article by A. Mitchell, on weather prognostics in Scotland, in the Edinburgh *New philosophical journal* (xviii. 1863, 221), where it is copied from a drawing by the Rev. C. Clouston: it is probably the same figure that is given in a work by the latter author, 'An explanation of the popular weather prognostics of Scotland,' etc. (Edinburgh, 1867); but this I have not seen. The drawing shows the cloud to be distinctly convex downwards, the separate festoons being grouped together somewhat like the adjacent grapes on a bunch; and it is spoken of as a sure sign of stormy weather. Its relative rarity may be estimated from a note by Symons, the veteran English observer, in his *Meteorological magazine* for July, 1868. He first saw it early in the morning of a June day in 1858, just before a violent thunder-storm; then during the succeeding ten years he never saw it, or heard of its being seen, till he came upon the book above mentioned. He said it looked like 'bags of sand,' but does not refer to it as a falling cloud.

Poey, a lifelong student of cloud-forms, sent a brief note to *Nature* (Oct. 19, 1871, p. 489), in which he speaks of this cloud as a new form, and gives a rough figure of it: he considers it very rare, having seen it but twice in his life, both times suspended from the pallio-cirrus of thunder storms, — once in Washington, D.C.; again in Beloit, Wis. This note brought out several others; among them one signed 'J.,' evidently by Jevons, calling attention to his

early account; another by Scott, in the *Quarterly journal of the royal meteorological society* (i. 1873, 55–59), in which most of these references are mentioned.

Further attention to the festoons is given in Poey's little book, 'Comment on observe les nuages pour prévoir le temps' (Paris, 1879, 86), and in Ley's review of it in *Nature* (Jan. 1, 1880, 210). The former calls it '*globo-cirrus*,' and traces its first mention back to Lamarck in 1804; but Poey finds only twenty records of the cloud that he can recognize, seventeen of them being connected with storms. Ley calls the festoons *mammato-cumulus* and *mammato-cirrus*, figuring both kinds, and noting that they are certainly not common, although not nearly so rare as is usually supposed. Abercrombie notes that the festoons result from the failure of the ascensional current that is commonly associated with showers and squalls (*Nature*, May 24, 1884).

My object in writing is to ask if the cloud is commonly seen in this country, and if it is then generally associated with the cirro-stratus of thunder-storms, or with the larger storms that are so unfortunate as to have no special name, unless we call them 'areas of low barometer.' My note books record the festoon clouds twice in Montana in 1883, twice during the past summer of 1885 in Connecticut and New York (all these being in the cirro-stratus cover of the afterpart of thunder-storms), again here in Cambridge, on Dec. 13, 1885, about noon, in the pallio-cirrus sheet attending one of the above-named 'areas,' and at a distinctly greater altitude than the low scud and intermediate cirro-stratus clouds that soon closed in, and gave us rain in the afternoon. They seemed in all cases to be gently falling cloud-masses of films, resembling the forms that ink may take when dropped into water; and, when watched attentively, they could be seen to descend and dissolve away. Are they as rare as the notes by Symons and Poey would lead us to think? W. M. DAVIS.

Cambridge, Mass., Jan. 5.

Topographical models or relief-maps.

I must personally thank you for your good words in behalf of non-exaggerated reliefs in your last issue, p. 24. I have had a long experience in this kind of work, and never found a case which required the vertical scale to be exaggerated. No relief of the surface is too delicate to escape the human eye when represented with sufficient skill and care in modelling. The demand for exaggeration in a relief comes from those who will not spend a sufficient amount of time and pains upon the intermediate contour curves, or from those who have not trained themselves in drawing from objects. The habit of exaggerating the relief excuses itself at first on the plea that common people cannot appreciate heights when true to nature, but the fact is that the difficulty is felt by the modeller himself; and when the habit is once formed, it becomes incurable. If a relief-map be not true to nature, what is the good of it? Geologists have been forced to abandon exaggerated cross-sections; why should they permit relief-map makers to revive the discarded error, and put the representation of the whole in antagonism to the representation of the parts?

About the year 1865 or 1866 I made a wooden model of one of our lower Silurian limestone valleys, with its bounding ridges, about 20 miles long. The model was about 18" by 36", in 12 bars of wood, each 18" long by 3" wide. On each side of each bar I painted the corresponding section of the valley, with its limonite horizons, and faults. The model still exists. My purpose was first to get correct ideas of the country structure for my own work, and then to exhibit my conclusions to the Pennsylvania railroad company, who employed me. The reliefs in the valley were very low; but they were perfectly legible to the eye of a layman. What would have been the fate of my side-sections had I used an exaggerated vertical scale?

In 1865 I made a model of the underground of the Plymouth anthracite mine, with its remarkable vertical fault, from levels which I took in the mine. What good would this have been had I used a different vertical scale?

I have myself made models on several plans; the most satisfactory, but the most laborious, being to draw a good many cross-sections on the same vertical and horizontal scale, along parallel lines, as nearly as possible at right angles to the general strike: then cut strips of wood, lead, zinc, or stiff paper (I have used all four) to represent the cross-sections; set these up in their places; fill in with wax or plaster; and finally tool the surface thus obtained. I prefer this method to the common one of jigging out the contour curves, and filling the terraces between them with slopes of wax. The latter method is easier and less costly; but it is sure to make the modeller slovenly in his geological representation, and it is a powerful seduction towards exaggeration of the vertical scale. Beginners and earnest scholars ought not to be allowed to use this method until they have been drilled to accuracy, and to love the true natural aspect, by the compulsion of the method of cross-sections. I never see a false relief-map without indignation, and a touch of the contempt we feel for all anachronisms. J. P. LESLEY.

Philadelphia, Jan. 10.

The cherry tortrix.

This insect, Cacoecia cerasivorana Fitch, was very common in Michigan the past summer. The most interesting thing about it is the large web or tent which it spins, and in which it usually stays. As it needs more food, it 'ropes in' new twigs, and thus has fresh foliage right at hand. I found that these little caterpillars would deflect a shrub, an inch or more in diameter, several inches, that its leafy branches might be brought into its tent. How do these little larvae exert so much force? I know that entomologists usually say it is by the pulling of the hundreds of larvae as they move their heads back and forth in the operation of spinning; but I do not see how they can pull. As they touch their mouth to the web or twig, the liquid secretion adheres, and quickly hardens into a tough thread; but the larvae do not seem to draw, nor is it certain that the thread would be strong enough so early in its formation to draw with any force. From very careful observation in the laboratory, I was led to believe that it was due to the contracting force of the many hardening silk threads that brought the large twigs together. These larvae are smooth, and must find the web a great protection. The teeth on the chrysalides are of great service in enabling them to push out of the tents, just as the moths are to issue. A. J. COOK.

Lansing, Mich.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 15, 1886.

THE EIGHT-HOUR DAY.

CONSIDERING the interest which is everywhere awakened in face of the coming determined agitation for an eight-hour day, the pamphlet by H. W. Fabian, on 'Der gesetzliche achtstundige normal-arbeitstag' (*Social science publishing company*, New York), is quite opportune. It constitutes the first number of a cheap series devoted to economic and social questions. Apart from its purpose of concentrating certain facts concerning the development of legislation on this subject, it is perhaps noticeable as indicating the diffusion of the writing and theories of Marx. His philosophy is accepted as laying the basis for state action in economic matters. It is a debated question, even among the labor-leaders, as to whether they will be able to carry into successful operation their plan for the general adoption of the eight-hour day on May 1, 1886. This is the date determined upon by the federation of labor unions of the United States and Canada. Such a thorough-going undertaking has immense difficulties before it, if it is managed simply as an economic movement. Many trades are not thoroughly organized; large numbers of workmen have no savings; and of course, if a general strike in all industries be resorted to, there could be little hope of mutual aid. Again: the system of piece-work is a standing obstacle. This is seen in the case of cigar-makers who work in tenement-houses. Mr. Fabian, therefore, urges the necessity of combined political action: economic forces alone are not sufficient. Those who are perplexed and possibly exasperated by this movement should make themselves familiar with the history of the labor-day. Even so conservative an investigator as Thorold Rogers has shown, that, in battling for the eight-hour day, the workman is only claiming his inheritance which he possessed less than five centuries ago. The demand is not a radical one; and no question was ever more temperately discussed than this at the recent Washington labor congress. For more than a quarter of a century the working-day in Australia has been of but eight hours; and last April the anniversary of its introduction was celebrated by artisans, manufacturers, and government officials. All these united in a declaration of its success. E. Y.

SHELL-FISH IN CONNECTICUT.

THE 'Fifth report of the shell-fish commissioners of the state of Connecticut,' for 1885, shows that the total area of oyster-grounds, for which application has been made to the commission (or their predecessors in certain places, the town committees) exceeds a hundred and twenty-four thousand acres. This, it is understood, excludes all natural beds or property owned by towns for the common benefit. Of the total, nearly eighty thousand acres have already been granted, of which sixteen thousand two hundred are under cultivation. Such portions of the remainder as are held for speculation, and not cultivated, revert to the state after five years, at the order of court, on a proper showing. In 1885 there were four hundred and twenty-three tax-paying cultivators, and the nominal price fixed on the grounds has yielded the state over fifty thousand dollars. The commissioners recommend the repeal of that section of the law which excludes non-residents from its privileges; as the local oyster-growers have had full opportunity for securing such lands as they could use, and, ignorantly or intentionally, non-residents have secured ownership through a merely fictitious compliance with the letter of the law. Of taxes levied, all but fifty-five dollars have been collected; the tax produced nearly eight thousand dollars the present year, and nearly eighteen thousand dollars during the entire three years. Much available ground still remains open to designation.

The experience of cultivators shows, that with proper dredging vigilantly kept up, and a suitable state supervision of the natural beds, the starfish may be kept under so as to do but little damage. A new pest was reported in the worm Sabellaria vulgaris Verrill, which builds interlocking sand-tubes with great rapidity, which, when numerous enough, smother the oysters on which they rest. One bed containing seventy-eight thousand bushels was nearly destroyed in this way; but it seems that such a result is very rare, as no further serious damage from this cause has been reported, and it is possible the loss in question was over-estimated.

The oyster-fleet of 1885 comprised 49 steamers, with a capacity of 50,525 bushels.

Mr. Bogart, the efficient engineer of the comission, reports on his part of the work, which is chiefly occupied with the survey of the state oyster-grounds, and the determination of bound-

aries of private claims, — often a difficult task, owing to their distance from shore.

The laws relating to shell-fish, passed since the date of the last report, are appended. The only one of general importance makes the rights to oyster-grounds personal estate, and not realty, in settling property of deceased owners.

The example of the state of Connecticut, in full accordance with the business sagacity which characterizes her citizens, might well be followed by other states even more deeply interested in oyster-culture. The natural beds of Maryland and Virginia are being rapidly destroyed for commercial purposes, and only a prompt attention to the subject can secure their rescue from impending destruction.

DATE OF VINTAGE.

M. ANGOT contributes a long discussion of the date of vintage in France to the annals of the *Bureau central météorologique* for 1883, issued with date of 1885. His data for some stations reach back to the fourteenth century, and, for a good number, back well into the eighteenth century. His conclusions may be briefly summarized as follows: 1°. The date of vintage varies greatly from year to year, and may in a single country differ by more than seventy days in different years. 2°. The date of maturity depends chiefly on the vines having received a certain quantity of heat, well determined for each species. 3°. Slight variations in the mean date of vintage are found; but these variations are unlike in neighboring regions, and they show no persistent deterioration of climate. 4°. No relation is found between the date of vintage and the sun-spot cycle. 5°. Abundant vintages occur in rather warm years, with nearly normal rainfall: they are less dependent on a concurrence of favorable conditions than on the absence of frosts, hail, diseases of the vines, etc. 6°. Years of good wine have a notable high temperature from June to September, and generally a slightly deficient rainfall. 7°. Years of poor wine are cool in the summer, with rain a little above the normal. Since 1880, detailed observations have been made on the vintage in France, and in future it will be regularly discussed.

The accompanying cuts are reduced from Angot's plates. Fig. 1 shows the budding of the vine in spring-time, as determined by the arrival of the mean diurnal temperature of 9° C. (48° F.), which is provisionally accepted as the time of the beginning of its vegetation. The position of this isotherm for every ten days of February, March, and April, is given by heavy lines: for some intermediate dates, by finer lines. The epoch of vintage in the autumn is similarly expressed in Fig. 2.

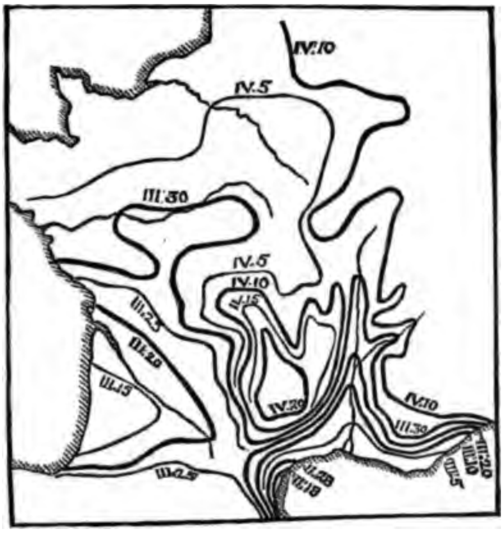


FIG. 1.

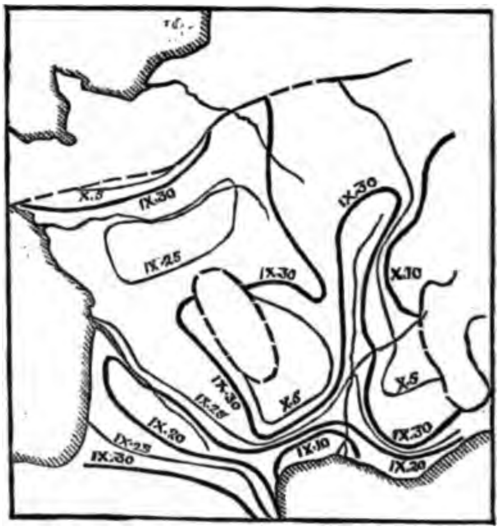


FIG. 2.

The same author has also attacked the distribution of heat on the earth as directly furnished by the sun, giving the basis of what Hann calls the solar climate. Meech is most frequently quoted on this question, and Ferrel has lately discussed it; Angot adds the consideration of various co-efficients of atmospheric transparence, and thus makes a step from the theoretical towards the actual. For example: according to Meech, the

heat received in twenty-four hours from the sun on the summer solstice is not greatest at latitude 23½°, where the sun is vertical, but has two maxima farther north, — one at 43°; the other and greater at the pole, with a faint minimum at 66°; because the sunshine at the pole through twenty-four hours, at a constant altitude of 23½°, is greater than the sunshine in the twelve-hour day at the tropic, with the sun vertical only at noon. But this gives a very erroneous idea of the temperatures at these latitudes. Now, on the assumption that two or three tenths of a vertical ray are absorbed by the atmosphere, Angot finds the maximum of heat received at the bottom of the atmosphere on the solstice has its maximum at 35°; farther north, the heat received diminishes continuously to the pole, rapidly at first, then slowly beyond the polar circle; and this is fairly conformable to the distribution of temperature. An interesting calculation shows, that, on account of our less distance from the sun in December than in June, the latitude circle about 2½° north, and not the equator, receives the same amount of heat on the two solstices: the equator, therefore, belongs in this respect to the southern hemisphere. The memoir is illustrated by an instructive series of curves showing the distribution of heat over the earth at numerous dates. W. M. D.

SODA AND POTASH IN THE FAR WEST.

IN view of the large quantities of soda and potash in various forms that are imported into this country, it is surprising that the abundant supplies of these alkalies within our own borders are not more extensively utilized.

It is probably known to all American geologists that there are extensive deposits of the chloride, sulphate, and carbonate of soda at many points in the arid regions of the far west, which may be had for the trouble of gathering. These deposits occur in the desiccated beds of ancient lakes in Nevada, Arizona, western Utah, and portions of California and New Mexico. There are certain lakes, also, which are valuable brines.

In the basins where evaporation has been nearly or quite complete, the alkaline salts occur either at the surface, when they appear like fields of snow frequently many square miles in extent, or they may be concealed beneath the layers of fine mud known as playa deposits. Again, large areas in Nevada and Arizona are white with alkaline salts that have been brought to the surface in solution, and deposited when the waters evaporated. These efflorescences are frequently rich in sodium carbonate, sulphate, and borate, and have been utilized to a limited extent at a few localities.

The lakes of the far west which are likely to become of commercial value on account of the alkaline salts they contain are Great Salt Lake, Utah; the Soda Lakes, near Ragtown, Nevada; Mono and Owen's lakes, California; and Summer and Abert lakes, in Oregon. All of these are without outlet, and owe their high percentage of mineral matter to the concentration by evaporation of the waters of streams and springs with which they are supplied. Their chemical composition is shown in the following table: —

CONSTITUENTS.	Great Salt Lake, Utah (1869).[1]	Soda Lake, Nevada (1883).[2]	Mono Lake, California (1883).[3]	Owen's Lake, California (1876).[4]	Abert Lake, Oregon (1883).[5]
Sodium (Na)	49.690	40.919	18.100	21.650	2.773
Potassium (K)	2.407	2.357	1.111	2.751	10.637
Calcium (Ca)	0.255	....	0.278	trace	....
Magnesium (Mg)	3.780	0.245	0.125	trace	0.(02
Lithium (Li)	trace	....	....	trace	....
Chlorine (Cl)	83.946	40.851	11.610	13.440	8.220
Bromine (Br)	trace	....	....	....	....
Carbonic acid (CO_3)	....	16.854	11.465	13.140	4.547
Sulphuric " (SO_4)	9.858	11.857	6.520	9.362	0.497
Phosphoric " (HPO_4)	....	....	....	trace	....
Nitric " (NO_3)	....	....	....	trace	....
Boracic " (B_4O_7)	trace	0.286	0.153	trace	....
Silica (SiO_2)	....	0.278	0.268	0.164	0.064
Alumina (Al_2O_3)	....	....	....	trace	....
Total parts per thousand	149.936	113.647	49.630	60.507	26.740

1 Analysis by Prof. O. D. Allen, U. S. geol. explor. of the 40th par., vol. ii. p. 435.
2 Analysis by Dr. T. M. Chatard, Bull. No. 9, U. S. geol. surv., p. 28.
3 *Ibid.*, p. 26.
4 Analysis by Dr. Oscar Loew, Ann. rep. chief of eng., U.S.A., 1876, p. 190.
5 Analysis by Dr. F. W. Taylor, Fourth ann. rep., U. S. geol. surv., 1882–83, p. 454.

It is safe to predict that Great Salt Lake will not only be of great value in the near future on account of the immense quantities of common salt it is capable of producing, but also for the sodium sulphate it contains. When the temperature of the lake-water is reduced to 20° F., the separation of sodium sulphate takes place as a flocculent precipitate, which increases in quantity with decrease of temperature. This should suggest to manufacturers a method of obtaining the salt in a pure state and on a large scale. When the temperature of Great Salt Lake is lowered on the approach of winter, its waters become opalescent, owing to the precipitation of sodium sulphate in an extremely finely divided state. During the winter months the temperature of the air in the region of the lake sometimes falls to 20° or more below 0° F., and at such times the separation of sodium sulphate takes place on an immense scale, and it is thrown up on the shore in thousands

of tons. The amount that could be gathered at such times is practically unlimited. As railroads now touch the shore of the lake, the problem of supplying this salt to manufacturers is simplified.

The Soda Lakes, situated on the Carson desert, Nevada, about fourteen miles east of Wadsworth, have already been utilized as a source of sodium carbonate, which is being shipped to San Francisco. These lakes occupy the craters of extinct volcanoes, and the mineral matter they contain has been derived mainly from the leaching of the lapilli and lacustral deposits surrounding them.

Mono and Owen's lakes are now quite accessible by rail, and are capable of furnishing immense quantities of sodium sulphate and carbonate. From data obtained during a recent survey of Mono Lake, it has been estimated that it contains,

Potassium chloride (KCl)	8,998,856	tons.
Sodium chloride (NaCl)	73,524,285	"
Sodium sulphate (Na_2SO_4)	40,636,089	"
Sodium carbonate (Na_2CO_3)	78,649,194	"
Total of salts in lake	209,233,488	"

It has been estimated by Dr. Oscar Loew that Owen's Lake contains about twenty-two million tons of sodium carbonate, and a little less than one-third of this amount of sodium sulphate.

Summer and Abert lakes, situated in southern Oregon, are remote from railways, but are extremely valuable brines on account of the potash salts they contain. These lakes occupy depressions in the bed of an ancient lake of large size, now nearly desiccated, and are very similar in character. Abert Lake alone has been analyzed, but it is probable that its companion has nearly an identical composition. Abert Lake is about fifteen miles long by five miles broad, and has an average depth (varying with the seasons) of approximately ten feet. Summer Lake is perhaps a third larger, and is also shallow; but its average depth is unknown. The percentage of potassium salts in Abert Lake is greater than in any other lake the composition of which has been published, amounting to five-sevenths of the total of solids in solution.

With these abundant resources at hand, the alkali industry of the far west unquestionably has a great future; and it is to be hoped that it will soon receive the attention that its importance demands.

I. C. RUSSELL.

CHOLERA MORTALITY IN EUROPE DURING 1885.

CHOLERA as an epidemic has now for some time almost entirely disappeared from southern Europe, and hence the following results of the serious outbreak of the past year, from the *Lancet* of Dec. 26, will be of interest: From the mainland no further record of cholera is forthcoming; but in the Christina Islands to the south, near the mouth of the Guadiana River, recurrences of the disease are still said to take place. The actual number of deaths recorded in the provinces and cities named is less than that which really occurred; for the official lists were not published with sufficient regularity to insure accurate records day by day, and outbreaks in some localities were never announced at all. The following is the list of places attacked, with their respective cholera mortalities; the capitals of the several provinces being, except where otherwise noted, included for statistical purposes within their provinces: —

Locality.	Deaths.	Locality.	Deaths.
Province of Castellon	4582	Province of Zamora	451
" Valencia	13400	" Soria	581
" Madrid	2228	" Ciudad Real	905
" Murcia	3580	" Barcelona	791
" Saragossa	10954	" Lerida	881
" Cuenca	2877	" Gerona	215
" Alicante	4861	" Navarre	2691
" Toledo	2289	" Valladolid	1482
" Teruel	4938	" Guadalajara	261
" Tarragona	1258	" Logroño	541
" Albacete	2347	" Burgos	199
" Jean	1338	" Huesca	69
" Badajoz	337	" Palencia	374
" Segovia	351	" Santander	194
" Cadiz	368	" Salamanca	84
" Granada	9162	Aranjuez, pr. of Toledo	885
" Cordova	825	Gibraltar (English)	34
" Almeria	2514	Gibraltar (Spanish lines)	191
" Malaga	685		

In France the disease was all but limited to Marseilles and Toulon, and to scattered cases in the south, until November, when an outbreak occurred in Brittany, Brest and its immediate neighborhood being affected. The total cholera deaths at Marseilles were just short of 1,000, and at Toulon just short of 200. The number at Brest has not been made known. In Italy only scattered cases occurred at several places on the mainland; but in the city and province of Palermo, in the island of Sicily, a considerable epidemic occurred, the total mortality there reaching at least 2,430. There was also a rumor of cases as late as the present month in the province of Venice.

BURMAH, PRESENT AND FUTURE.

MR. HOLT HALLETT, in a recent address before the London Society of arts, on 'Burmah,' said: In these days, with foreign competition getting keener every day, and hostile tariffs not only shutting the Europeon markets against us, but in a lesser degree American and English colonies also, with the race for fresh colonies and new markets among European powers, it is of importance that we should avail ourselves of our present opportunity for an inland connection and

commercial alliance with Indo-China and China, and thus acquire new markets of transcendent promise.

Burmah and the Burmese Shan states are highly favored by their geographical position. They lie in the course of the monsoons, and are gifted for the most part with a plentiful rainfall.

The Irrawaddy is a river which discharges about 420,000,000 metric tons of water during the year. The river is about 900 miles in length, the last 240 being in British territory. As far south as Akouktoung its bed is rocky; farther down it is sandy and muddy. New sand-banks are continually forming, and old ones being removed, which renders it necessary for the steamers plying between Rangoon, Mandalay, and Bhamo, to have a service of pilots upon the river. In the rainy season, steamers and large boats enter the main river from Rangoon by the Pan-Hlaing Creek; but during the dry season they have to descend the Rangoon River for some distance, and proceed by different routes into the Irrawaddy.

The Khyeng-dwen is navigable for the largest boats plying on the Irrawaddy, and for steamers certainly as far north as Kendat, and most likely as far as the rapids which occur a little above the junction of the Ooroo River. A great deal of grain is grown in the lower portion of Khyeng-dwen valley, and likewise in that of the Ooroo, near the sources of which are the serpentine mines. The lower portion of the river passes through a broad, populous, and fertile champaign, and presents an almost continuous horizon of palmyra-groves, always in Burmah a sign of population and culture. From these there is a considerable manufacture of palm sugar. The sugarcane is generally used by the Burmese merely for munching; but, according to Colonel Yule, a little sugar is made from the cane in the neighborhood of Ava.

Bhamo, on the course of the Irrawaddy, is the entrepôt of trade for north-western Yunnan, and will certainly become under our rule a place of great importance, as it is the terminus of the shortest caravan routes into western China. For some time it was proposed by many of our officials to improve the caravan route by the construction of a wheeled road, and even a railway; but subsequent explorations have shown that although Bhamo, which is 430 feet above sea-level, is only 250 miles distant in a direct line from Talifu, yet a railway would have to be 600 miles in length to connect these places. The cost of a railway connection by this route would be at least four times as great as that proposed by Mr. Colquhoun and myself, which, besides, has the great advantage of terminating at a seaport instead of at a town 840 miles up a river, of opening up the whole of central Indo-China, and of passing through a much more fertile and better populated region than would be traversed by the other route. Bhamo will no doubt, before long, be joined by rail, *via* Mandalay, to our Rangoon and Tounghoo railway, and subsequently to the Indian system at Dibrugarh; thus tapping the whole of the passes leading from the west of the Shan states, and completing one of the schemes long ago proposed by my colleague and myself.

The inhabitants of Burmah, owing to the excellence of the climate, are robust and healthy looking. They attain the average length of human life, and children especially thrive in the country. The registration returns show that in Burmah the deaths of children under five years of age are in the proportion of 27 to 85 of the total deaths at all ages, whereas in England they are 40 per cent. Concerning the characteristics and peculiarities of the Burman, much need not be said. His virtues, which are many, and his failings, which are not a few, are much the same here as in every part of his extensive country. He here, as elsewhere, displays much spasmodic energy and general laziness; much love of feasts and shows; much disregard of the sacredness of human life, and much tenderness for the lives of inferior members of the animal kingdom: much arrogance and inconsiderateness when placed in high position; and last, though not least, much general truthfulness, and, among unsophisticated villagers, the very un-oriental trait of being quite unable to tell a specious falsehood, — a trait which is as honorable to himself as it is agreeable to those who have the government of his country. His occupations are cultivation on a small scale and petty trading. Actual poverty is almost unknown, but riches are never accumulated. The Burman is strongly distinguished from the Indian races by his love of sport and amusement, and his strong turn for the ridiculous. The Burman is in every way a marked contrast to the Hindoo. Their women-folk mix freely in all social gatherings on perfectly equal terms, and form a very important factor in society.

Proceeding to speak of British Burmah, Mr. Hallett said that only one-half of the area of that country is culturable, and only one-seventh of that half is under cultivation. Taking the present population at 4,000,000, there is room for 24,000,000 more without overcrowding the province. Even now about 1,000,000 tons of rice are exported every year, after feeding the population, cattle, and elephants.

It is therefore certain, that, if all the reclaimable waste lands were brought into tillage, Burmah would be unrivalled as a granary. The population of British Burmah has increased from 2,747,141 in

1872, to 3,736,771 in 1883. Trade has more than kept pace with the advance of population and revenue, as the following figures will show: In 1874 the imports were £1,859,095, and in 1883, £3,772,887. In 1874 the exports were £3,480,407, and in 1883, £7,039,525. The relative increase of the imports is somewhat greater than the increase in exports; but, with the balance of trade so strongly in favor of the province, its capacity as a consumer of British manufactures is very imperfectly measured by the actual value of the imports. Again: the comparatively small amount of those imports demonstrates conclusively that upper Burmah has acted as an effectual and insurmountable barrier between the port of Rangoon and those illimitable commercial requirements of western China and the Shan states which it has been the hope of the government and merchants alike to ascertain and to satisfy. Rice represents 80 per cent of the total exports. The other chief exports are teak, cotton, jade, petroleum, spices, tobacco, hides, horns, ivory, India-rubber, shellac, cutch, and drugs. Of these, teak forms 7 per cent of the total exports, and cotton 2½ per cent.

The statistics of the province show that one of the chief wants is population, — a want which our connection with India and China would make it easy for Madras, Bengal, and China to supply, thus adding materially to the producing capacity and general prosperity of the province.

SOME RECENT TEXT-BOOKS ON METHODS IN MICROSCOPIC ANATOMY.

THE rapidity of the improvements recently made in methods devised for carrying on all kinds of zoölogical investigations has resulted in the establishment of journals largely, or even exclusively, devoted to the diffusion of information in technic. The amount of valuable experience already acquired over a field much broader than that covered by the older text-books on histology has rendered it imperative that the sources of this widely scattered information should be systematically reviewed with the purpose of collecting its important and really valuable elements, and putting them into a shape convenient for use both by beginners and by such investigators as are wise enough not to waste time by remaining content with the scanty methods and appliances of twenty, or even ten, years ago.

The value of the text-book which summarizes the present acquisitions in this field will depend upon several things, but principally upon the critical knowledge and experience which its author brings to bear on the selection of material, and the method of treating his subject.

Since the publication of the first part of Fol's 'Lehrbuch der vergleichenden mikroskopischen anatomie,'[1] in 1884, there have appeared several books having this general purpose in view. The immediate aims of the three mentioned below[2] are not quite identical: each fills a place not fully occupied by either of the others. The first is primarily intended for the beginner, to whom sources of difficulty and their remedies are explained; the third, while intended first of all for 'the instructed anatomist,' also aims to be of use to the beginner; the second takes a middle ground between the other two, in that it does not aim to be 'an exhaustive treatise of the subject in any of its aspects,' but endeavors to meet 'the every-day needs of a zoölogical laboratory.'

In a small pamphlet of about forty pages, Kükenthal has brought together concise practical directions covering the more important of the recent technical methods employed by zoölogists. The statement in the preface that this little book contains nothing essentially new is realized. At the same time, it meets very satisfactorily the needs of a beginner: for the selections made are, on the whole, judicious; and the descriptions, though brief, are intelligible and to the point. About one-third of the book is devoted to the processes (illustrated) of embedding (chloroform-paraffine), sectioning, and affixing sections; but the space devoted to embedding in gum, albumen, and celloidin, is too brief to be of much service. Its compact and unpretending form puts this little pamphlet within easy reach of every beginner, and those to whom German is no impediment will find it serviceable.

Whitman's work is an immediate outgrowth from his editorial labors, in connection with the department of microscopy in the *American naturalist*; but it is much more than a compilation of matter already published there. Although the book is called '*Methods* in microscopical anatomy,' etc., its scope is somewhat broader than that of the two other works, for '*material* and *methods*' sums up the author's view of the needs of the zoölogical laboratory; and upon both points he aims to be of service.

Part i. deals with general methods, which are

[1] For a review of Fol's book see *Science*, vol. v. p. 510.

[2] *Die mikroskopische technik im zoologischen praktikum.* Von Dr. WILLY KUEKENTHAL. Jena, *Fischer*, 1885. 16°.

Methods of research in microscopical anatomy and embryology. By CHARLES OTIS WHITMAN. Boston, *Cassino*, 1885. 8°.

The microtomist's vade-mecum; a hand-book of the methods of microscopic anatomy. By ARTHUR BOLLES LEE. Philadelphia, *Blakiston*, 1885. 12°.

introduced by a few pages intended to orient the beginner as to the proper sequence of steps in the more difficult work, and to acquaint him with the facts and underlying reasons connected with killing, hardening, and staining. The chapter on reagents (preservative, macerating, decalcifying, etc.) is followed by methods of staining, metallic impregnations, and bleaching. Microtomes, together with their auxiliaries and methods of embedding (freely illustrated), occupy two chapters, and the remaining three of the first part are devoted to methods of fixing serial sections, to mounting media, etc.

The second part, which occupies about half the volume, contains some matter not previously published. About fifty pages are devoted to 'embryological methods.' This chapter furnishes much valuable information, but the arrangement leaves the impression that it is the result of fortuitous reading rather than a methodical search for the most valuable things within the scope of the topic. The chapter on 'Times and places of ovulation' serves at least to call attention to the desirability of a more extensive compilation of the facts hitherto published on this subject, as a means of aiding less experienced students in their search for embryological material. The methods employed in studying karyokinesis during cell-division and in the preparation of nervous tissue are considered separately from 'Histological methods,' without any very apparent reason. The important methods of reconstructing the object from microscopic sections introduced by His, Born, and others, form the concluding chapter, which is followed by an appendix principally devoted to recent methods of injecting.

Although not exhaustive, nor perhaps symmetrically planned, both the matter and the manner of the book commend it to every advanced and advancing zoölogist as well as to beginners; and it is for that very reason that one interested in real scientific progress the more regrets to see a publisher possessed of the idea that his interests demand the production of a book twice as bulky and twice as expensive as it need be.

Lee's book is the outcome of a more pretentious undertaking. The author has desired to produce 'a concise but complete account of all the methods of preparation that have been recommended as useful for the purpose of microscopic anatomy.' Whatever opinion one may entertain about the desirability of a manual framed on so catholic a plan, it must be admitted that the author has brought together an immense amount of material in a compact and handy form, which goes far toward saying it will get used; for the bookmaker who makes books for any but people of superfluous leisure, must make them so that they can be consulted without waste of time.

Notwithstanding a natural prejudice which one experiences when an author declines to use his judgment for the reader's benefit, it must be granted that Lee's work is not edited without discrimination, for the brief but valuable introductions which precede the more important topics show that the author is fully alive to the principles underlying manipulations. The citation of the sources of the formulae gives to the student the requisite opportunity for ready verification and control, and the plan of using serial numbers to indicate the successive sections of the book is economical both for author and reader. The latter would have been spared much time, if a column for page-references had been added in the index.

The 'vade-mecum' is practically without illustrations, and, although supposed to be 'exhaustive,' appears to have ignored the important aids to killing animals in a distended and natural condition which are afforded by certain stupefying reagents, such as nicotine, chloral hydrate, etc.

The author defends the nature of his publication — from which "no process having any claim to scientific status has been rejected, nor any (he trusts) unwittingly omitted" — on the ground that (though "a large proportion of the formulae are quite superseded in modern practice") "some one or other of them may perhaps serve, in some way that cannot now be foreseen, to suggest some new method of value;" and he enforces his opinion by reference to the history of the use of corrosive sublimate. He, however, uses the knife (and how could he fail to?) when he comes to the matter of 'cements and varnishes.' The magnitude of the undertaking has also compelled him to modify his original plan of making the second part traverse the entire field of histology and microscopic zoötomy, "giving the student detailed instructions for the examination of all structures that have hitherto been studied, and thus making him entirely independent of all help from a teacher."

The author, therefore, limits himself in the special part to about one-fourth of his four hundred pages, and considers in it 'only very special cases,' such as cell-division, the microtomy of the human brain, etc. The histological part of the field has received much the larger share of attention, — the nervous system, nerve terminations, sense-organs, being very fully treated, — and the embryological only a fragmentary consideration. For this reason and others, the works of Lee and Whitman supplement each other in such a way that no one actively engaged in microscopic work can afford to dispense with either.

COOKING AND DIETING.

It was the privilege of the writer of this notice in August, 1884, to listen to a lecture on the chemistry of cookery, given at one of the conferences at the health exhibition in London, by the genial and enthusiastic author of the volume first named. After having personally urged the immediate publication in America, in book form, of his papers then appearing in the *Popular science monthly*, it can only be possible for the present writer to urge American readers to avail themselves of so much valuable information and sound sense, served up with so much entertainment as Mr. Williams furnishes in his manner of presentation, — a manner well calculated to catch the popular eye, but which at first glance may prejudice the scientific reader. A critical reading from the stand-point of a cookery chemist, as well as from that of a chemical cook, has failed to reveal any errors of statement as to the present condition of scientific knowledge on the subject of cookery. There are many doubtful points, it is true; but they are well stated in the volume before us, and the lines on which further research is needed are clearly indicated. The author, himself a living exemplification of the fact that good cookery allows good health and good spirits, is a chemist and metallurgist, a student yet, though he is rather past middle life. He shows himself well acquainted with laboratory methods of experimentation, and also with practical cooking.

In Mrs. Henderson's book one is startled to find recommended as 'diet for the sick' a slice of Boston brownbread, with cream, for breakfast; fricassee of chicken, with potatoes *à la crême*, for dinner; macaroni and tomato-sauce, with pear compote, for tea. Evidently the author means by the sick, invalids and convalescents, people with delicate appetites which need to be tempted by dainty service and pleasant flavors. The book is not one for the hospital nurse, but for the lady companion of invalids and elderly people who cannot take exercise. The recipes seem to be excellent, and the directions for serving so as to increase the enjoyment of the food are admirable in points too often overlooked. The author has endeavored to incorporate the latest theories of diet into the cookbook with an enthusiasm which may prove to be well founded, and which may not. Grape-juice and hot water have become pretty well established: peptonized foods, koumiss, and whole wheat are less certain to hold their own. While the practical part of the book is so worthy of praise, it is to be regretted that the first chapter on the chemical composition of foods had not been omitted, or at least revised by a chemist.

The chemistry of cookery. By W. MATTIEU WILLIAMS. New York, *Appleton*, 1885. 12°.

Diet for the sick. A treatise on the values of foods, their application to special conditions of health and disease, and on the best methods of their preparation. By Mrs. MARY F. HENDERSON. New York, *Harper*, 1885. 12°.

Last April Mrs. Caroline Dall delivered an address in Washington, D.C., before the Shakspeare club of that city, on which occasion she refuted certain statements made by Mr. Donnelly respecting the 'cipher,' and various assertions of other parties relative to the ancestry, education, and character of the poet. These replies have now been embodied in a volume of some two hundred pages, entitled 'What we really know about Shakspeare' (Boston, *Roberts*, 1885). The author declares that she has endeavored to prepare a work which will show at a glance such facts pertaining to Shakspeare's history as are substantiated by contemporary testimonials and existing documents. In this she has admirably succeeded; but, as her book is intended principally for the use of beginners, it might be as well not to confuse them with theories such as those respecting Anne Hathaway's parentage, and her husband's travels in Germany and Italy. However, aside from a few minor speculations of this nature, the work is an admirable one, which cannot fail to assist the student by reason of its concise chronological arrangement, and the excellent index which terminates the volume. Those who are familiar with the plan of Mr. Tweddell's work, published some thirty years ago, will appreciate the labors of Mrs. Dall; and, in view of this fact, we sincerely trust that Mr. Halliwell-Phillipps will forgive her for misspelling his name whenever she has had occasion to quote it.

In Grand Lake, Sandy Lake, and other bodies of fresh water in Newfoundland, seals are known to breed in abundance, never visiting the sea. Like habits are said to be found in these animals inhabiting Lake Baikal in central Asia, twelve hundred and eighty feet above sea-level. In a pamphlet by Mr. Harvey, entitled 'Across Newfoundland,' the author is of the belief that these fresh-water lakes of Newfoundland have undergone a gradual change from a previous brackish or salty condition, and that the inhabitants have by degrees adapted themselves to their changed conditions. Grounds for this belief are afforded by the fact that other large bodies of salt water in Newfoundland are during periods of the year cut off from the sea, and might readily become permanently separated.

SCIENCE.

FRIDAY, JANUARY 22, 1886.

COMMENT AND CRITICISM.

DR. PERSIFOR FRAZER of Philadelphia has recently applied composite photography to testing the genuineness of signatures. He first obtained by composite photography a standard signature, and then he compared this with the signature in dispute. In the case of the composites of the heads on coins, or of portraits, it is tacitly assumed that the variation observed is due to a difference of the subject at different times, or to the different impression which the same subject makes on different artists. In the case of handwriting, however, the will-power of the writer attempts to reproduce exactly a certain combination of symbols in the same order as that usually performed; but the accidental physical obstacles or mental influences render this impossible. *A priori*, it would seem likely that a composite of a larger number of signatures would show an individuality little less distinct than the race, family, or pathological characteristics which thus far it has been the aim of those who have used this method to portray. In point of fact it turns out to be the case; but what was not foreseen is equally true; viz., that the very variations which appear on the plate, either as very faint lines or as blurs, furnish the most valuable aid in determining whether or not two pieces of writing are by the same hand. On examining carefully each letter of a composite made from a large number of signatures, it is found that the variations in writing a letter at different times, are confined to certain of its parts, and are not distributed equally over the entire field. Thus not only is there more uniformity in letters and parts of letters which lie close to the line, but in the upper loops, dots, and crosses, the tendency in all cases thus far examined is towards variation in one, or at most two, directions; and these are restricted more than one would suppose, who regards without critical analysis the writings from which the composites were made. It would be premature at this time to say with what certainty one might tell, after an extensive experience of the use of this sort of analysis, that two writings were or were not by the same hand. But the great gain, after all, is not altogether in the certainty which the method renders possible (though this cannot be ignored), but in the fact that it removes the judgment on affairs as delicate and often as important as the identification of handwriting from the possible bias of personal expert opinion, and allows the testimony of the photograph to be weighed by judge and jury like any other testimony. So far as Dr. Frazer has yet been able to observe, it is impossible to write naturally the signature, or even the hand, of any other person, without showing numerous discrepancies with the composite plate. The essential requisites to making the plate are of course as many signatures as possible, about which there can be no suspicion. In order to make the letters overlap as much as possible, it is sometimes found necessary to photograph them at different distances from the camera. It is a curious fact, that, when a man is obliged to restrict his whole signature to a space less than that to which he is accustomed, he will insensibly make a change, which is usually a close approximation to a reduced scale.

IN THE NUMBER of *Science* for last week we noticed the railroad running across the deserts of Asia towards Merv and Bokhara. This week we wish to call attention to the first well-developed plan for the construction of a railway connecting the interior of Africa with the Atlantic Ocean. On the 23d of December, 1885, an agreement was made at Brussels, between the independent state of Kongo, and delegates from the Kongo railway company of Manchester, granting to this company the right to construct a railway to connect the upper and lower Kongo. The delegates of the English company were Messrs. Hutton, M.P., president of Manchester chamber of commerce; Mackinnon, director of the British-Indian steam navigation company; and Stanley. The directors of the railway company are the three delegates before mentioned; and Messrs. Adamson, president of the ship-canal to connect Manchester with Liverpool; Jacob Bright; Lord Egerton; Sir James Ferguson, M.P., and former governor of Bombay; W. H. Houldsworth, M.P.; and H. M. Steinthal of Manchester. The capital

will be five million dollars, and subscriptions will be immediately opened in the capitals of the four states which signed the general act of the conference at Berlin. The railroad will be constructed within the territory of the state of Kongo, either on the south side of the river, between the frontier and Leopoldville, or in two sections, — one on the right bank of the river, and the other on the left.

LIEUTENANT TAUNT of the U. S. navy recently arrived in London from the Kongo, where he has been on a mission for the government. Mr. Tisdell's report of a visit to the lower Kongo, in which he painted so black a picture of unsuccess and sterility, will be fresh in the memory of our readers. The report which Lieutenant Taunt has to render bears a very different complexion: he did not content himself with a hurried visit to Vivi and Stanley Pool, but went as far as Stanley Falls. He describes the lower Kongo as in the main barren, but even there relieved by fertile spots. The administration of the Kongo state is severely criticised. Lieutenant Taunt finds that in the lower Kongo the officials do not retain their offices long enough: this is presumably to be credited to the extremely unhealthy climate, although no such reason is given by Lieutenant Taunt. On the upper Kongo he found the officials better contented, and the administration more satisfactory. It is understood that there is no prospect of Mr. Stanley proceeding to the Kongo in the near future; and there is a tendency to withdraw all officials not of Belgian nationality. Sir Francis de Winton has retired, and has been succeeded by N. Janssen. These changes may result in doing away with the jealousies formerly existing among the officials of different nationalities.

THE DECLINE OF CHOLERA in southern Europe has afforded ground for the hope that the epidemic had nearly ceased, or at least that the worst was over. From recent news, however, it appears that there yet exists cause for apprehension. The disease has broken out in the provinces of Cadiz and Malaga, and quarantine has been established at several seaports. It has approached the frontiers of Portugal, and it is very possible, if not probable, that it may break out with its previous intensity in the spring. Not only in Portugal, but in various provinces of Spain, evidence seems to indicate that the end of the epidemic is not yet.

ON ANOTHER PAGE will be found the proceedings of the first meeting of the Indiana academy of sciences. This society enters upon its existence under auspicious circumstances, and its future progress will be watched with interest. The list of names of the officers or participants, as given, includes not a few of men of acknowledged ability; and there certainly seems to be sufficient material among the scientific workers of Indiana to make the academy a success. Other state academies have led a feeble existence, from lack of material or proper management; may it be hoped that the future of the present one will be brighter.

THE COMPETITION OF CONVICT LABOR.

BACK of all the discussion as to the various methods of employing convicts, one of which was commented on in a recent number of this journal (*Science*, No. 153, p. 28), lies the complaint that any method whatsoever of utilizing convict labor, save in the work about the prisons, results in a competition with free labor which is unfair and injurious.

The idea that this competition really exists in an appreciable amount has taken possession of so many minds, that we offer a few statistics on the subject. It may at once be admitted, that were all the 60,000 convicts in this country employed in a single industry, under one scheme of management, the effect would be that an enormous addition would be made to the productive capacity of that industry, and consequently prices might fall, and a reduction of wages result. But this hypothesis is as far from the truth as possible.

In 1879 Col. Carroll D. Wright ('Eleventh annual report of the Massachusetts bureau of the statistics of labor,' p. 112) stated that such convicts as were employed at any kind of labor whatsoever throughout the whole United States were 40,128 in number, and were distributed among 129 penal institutions. Of this number, 23,524 — 22,288 males and 1,236 females — were employed in 108 kinds of industries requiring skilled labor; 11,668 — 11,450 males and 218 females — were employed in 25 kinds of industries requiring unskilled labor; the remaining 4,930 were employed in prison duties. These 23,524 convicts, employed in productive skilled work in the prisons of the United States, were competing (*ibid.*, p. 114) with 666,625 workmen employed in the same states upon the same kind of work, and with 1,269,240 in the whole United States engaged in the same productive industries that were carried on in the prisons: therefore the percentage of convicts to free laborers was 1.83.

Small as this makes the force of the competition appear, the real effect is smaller still. The competing power of the prisons was, as appears above, 23,524 convicts. But, relying on the most scientific tests and measures that the English prison managers have been able to apply to the productive force of convict labor, we find that it takes the labor of two convicts to equal that of one free laborer (see 'Report of the superintendent of state prisons of the state of New York for the year 1884,' p. 24). This results, of course, from the low mental and moral equipment of the average convict, as well as from the peculiar conditions under which prison labor is carried on. As it is a well-known fact that the artisans in the United States accomplish more work in a given time than their European competitors do, it will be necessary to allow for a somewhat higher standard of convict labor. Putting this allowance at 10 per cent, we find that the productive labor of an American convict is 60 per cent of that of the free workman.

Therefore, while the percentage of convicts to free laborers was 1.83, the competitive productive power of the former was only three-fifths of that, or 1.1 per cent. And it is this minute percentage of competition that has caused all the hue and cry against convict labor.

In a recent paper on 'The rate of wages,' Mr. Edward Atkinson of Boston, basing his statistics on the census of 1880, states that 17,400,000 persons are engaged in some gainful occupation. Of this number, 150,000 are in government employ: so there remain 17,250,000 producers, who, by exchanging products with others, also obtain the means of living, and thereby become consumers. 1,050,000 of these are engaged in mental rather than manual work; such are clergymen, lawyers, teachers, artists, chemists, engineers, officials of banks, railroads, insurance companies and corporations, merchants, traders, and dealers. When these are deducted, we have a remainder of 16,200,000, who constitute the actual working-class. 7,000,000 of these are farmers and farm-laborers, and the rest are artisans, mechanics, clerks, laborers, operatives, domestic servants, and other wage earners. The products of the mechanical industries of the United States amount to more than five thousand million dollars annually. The total product of the state prisons of the country is not over twenty millions per annum, or two-fifths of one per cent of the whole manufactured products of the country; and this figure is obtained by taking prison labor at a valuation of two dollars per day, — the average price for labor outside of prisons. As the convicts earn, on an average, only forty cents a day, their earnings represent a product of less than one-fifth of one per cent of the products of the United States.

We are convinced that those who participate in the crusade against the employment of convicts in productive industries on the ground of unfair competition with free labor, are innocent of any acquaintance with the facts and figures that bear on the question. NICHOLAS MURRAY BUTLER.

THE NEW VOLCANO IN THE PACIFIC.

THE *New Zealand herald* of Nov. 3 contained the following account of the recently reported new volcano in the Pacific: —

"In yesterday's paper we stated the news brought by the schooner Maile, that a new and vast volcano had arisen in the Pacific Ocean. A correspondent in Tonga, dating Oct. 19, gives the following particulars: 'At daylight on the 13th of this month (October) we observed dense volumes of steam, smoke, and clouds, ascending in a N. N. W. direction. At one o'clock P.M. on the same day proceeded in the Sandfly in that direction, having on board the Premier. Mr. Baker, Mrs. Baker, two Misses Baker, Mr. S. W. E. Baker, Miss Tuckow, Dr. Buckland, Rev. Mr. Watkin, Mr. F. Watkin, Mr. Wilson, Mr. S. Roberts, Prince Liponie, Chief Tongi, and several others; sailed sufficiently close that evening to see that it was a submarine volcanic eruption. Considering it not prudent to approach it any closer, night coming on, and thinking there might possibly be a set of currents towards it, shortened sail, and worked to windward of it, keeping it at a respectable and comfortable distance from us during the night. In the morning at daylight made sail with a fresh breeze from E. S. E. About eight A.M. my judgment was, we were about 1½ to 2 miles from the crater, it bearing then about N. W. I have not words to express my admiration and wonder at its changing splendor. Eruptions take place every one or two minutes, changing its appearance every second like a dissolving view. I can only say it was one of the most awfully grand sights I ever witnessed in all my life on the high seas. And now for the position, as near as I have been able to calculate at present, of the island that has been thrown up by this volcanic eruption. It is on the S. E. edge of Culebras reef, as placed on the chart by H. M. S. Falcon in 1865, and N. N. W. ½ W. magnetic, 14 to 15 miles from the island of Honga Tonga. As to the size or extent of the island thrown up, I am at present unable to state correctly, there being so much steam and clouds hanging about and over it: but I should imagine, from what little I could see of it, that it was from 2 to 3 miles long, S. W. and N. E.; height about

60 ft.; lat., 20° 21′ S.; long., 175° 28′ W. position of Sandfly Island, for we saw it rise. Got back again just too late to enter the reefs to Tonga. Anchored at Nukualofa at ten A.M. on the 15th. We had lovely weather all the time, a nice S. E. wind, and every one seemed highly gratified with what he had seen.'"

THE RECENT COLD WAVE.

THE accompanying minute maps are reduced from daily weather-charts published by the signal service, and represent certain features of the weather during the passage of the recent severe cold wave. The series of six maps (figs. 1 and 2), designed to show the changes of temperature from Jan. 7 to Jan. 12, are crossed by a heavy line that marks the altitude of 0° F. as determined by the observations at 7 A.M. on successive mornings. To the north of it, the dotted area extends to the isotherm of 30° below zero; the space shaded with lines, farther north, being colder still. The unshaded part of the maps contains the temperatures between 0° and 30° above; the next belt covers temperatures from 30° to 50°; and in a few of the maps, temperatures above 50° appear in the extreme south.

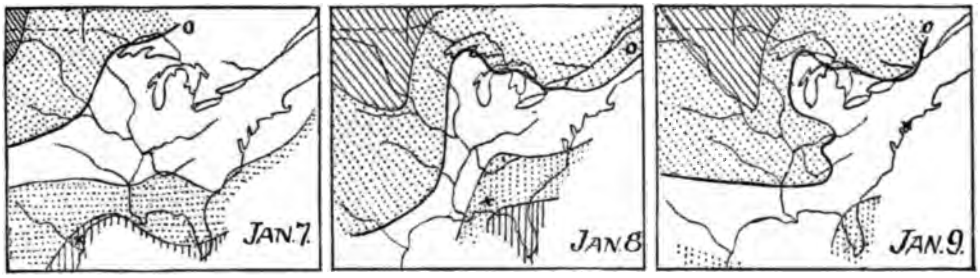


FIG. 1.

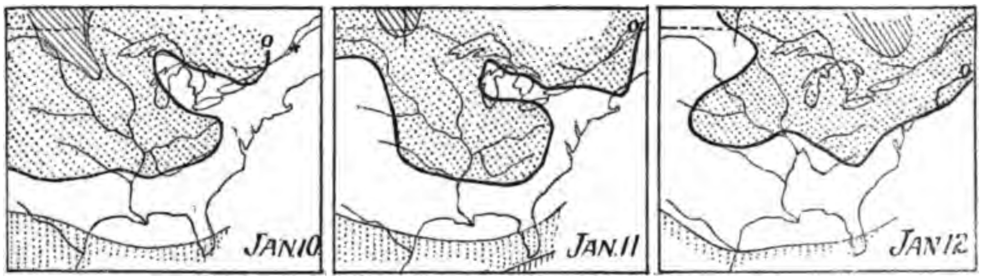


FIG. 2.

On the morning of Jan. 7, a storm-centre of moderate intensity lay in southern Texas, having come across northern Mexico from the Pacific; at the same time an area of high pressure, with very low temperatures, stood in the far north-west. As is stated by Lieutenant Woodruff in his recent note on cold-waves, areas of high pressure extend to the south and east with their low temperatures, while the antecedent storm-centres move off to the north-east. The wave here considered belongs to the third of Woodruff's classes, inasmuch as it first spread southward to Texas, and then east and north-eastward to the Atlantic coast. On Jan. 8, when the storm-centre was near Mobile, a fine 'norther,' such as would have delighted Redfield, swept down the plains to the Gulf, and Galveston was only about ten degrees warmer than Duluth. The zero isotherm stood just west of the Mississippi, running nearly north and south for about seven hundred miles. During the next three days, while the storm moved off over Labrador, the cold wave crept up the Ohio valley, where the temperature then stood distinctly lower than in Michigan, two hundred miles farther north. At last, on Jan. 11 and 12, the zero isotherm turned well north over the plains as more moderate temperatures returned.

The most interesting phase of this spell of weather was doubtless that presented on the morning of Jan. 9, when the storm had developed into a true cyclone, with nearly circular isobars, and remarkably low pressure at its centre in southern New Jersey. At this time the barometer

at Philadelphia read (reduced to sea-level) 28.69; it was 30.81 in the anticyclonic centre near Lake Winnipeg, a difference of over two inches in only

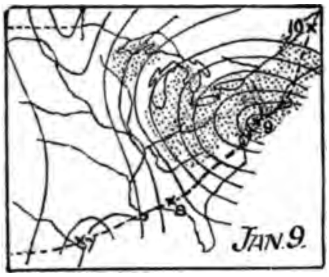


FIG. 3.

1,400 miles. This is illustrated in fig. 3, which gives the isobars for every even tenth of an inch; it shows also the area (dotted) over which snow was falling at this time; and the storm-track is traced by a heavy broken line, with a cross and a date to mark the place of the centre at seven o'clock in the morning while it lay within our territory. The numerous wrecks along our coast attest the violence of the winds at this time. When the monthly weather review for January comes out, we shall hope to find a detailed account of this storm, especially from those stations along the coast that lay close on the path of its centre.

Fig. 4, for the same date, is designed to illustrate the extraordinarily low temperatures brought by the cold wave in the rear of the cyclone. The

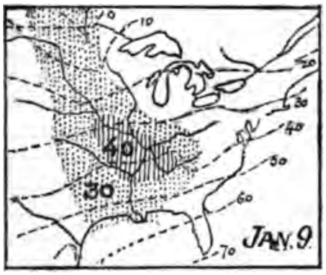


FIG. 4.

mean temperatures for January are taken from Lieutenant Greely's monograph (1881), and drawn in broken lines for every ten degrees. By comparing these with the six temperature maps above, the amount of departure from the normal may be estimated. The departure for Jan. 9 is given by two shaded areas, showing a depression of thirty and forty degrees respectively; this depression being calculated from the mean January temperature at 7 A.M., as given in the chief signal officer's report for 1884. The temperatures reached in the southern states on this and the following days are in all cases close to the recorded minimum of earlier years, and in many cases are lower than any thing known in the signal-service stations there. Altogether, the storm and the cold wave are perfect examples of their unpleasant kind.

W. M. D.

AMERICAN JOURNAL OF ARCHEOLOGY.

THE fourth number of the *American journal of archeology*, which has just appeared in Baltimore, completes the first volume, and fully sustains the high expectations which were entertained of its management. Nearly five hundred pages, illustrated by eleven plates and sixteen figures, have been given to the subscribers; but the quality of the articles is more noteworthy than the quantity. No other archeological journal of any country affords so comprehensive a view of the progress of investigation and discussion. All important reviews and monographs and books are noticed by competent readers and critics, whose names are appended as authority for the statements which are presented. The proceedings of societies are also recorded. Although chiefly concerned with the archeology of civilized nations, prehistoric remains are not neglected; but the effort is made to represent in one journal all the varied movements of the science. The managing editor, A. L. Frothingham, jun., Ph.D., by his complete familiarity with the French, Italian, and German languages, and by his long residence in Rome, has become acquainted with the leading authorities, and has been able to secure their encouragement, and to a considerable extent their co-operation in his undertaking. A list of those Europeans who have already made, or who have promised at an early day to make, contributions to the *American journal of archeology*, includes the names of such well-known persons as Piper of Berlin; Reber of Munich; Michaelis of Strassburg; Schreiber of Leipzig; Ramsay of Oxford; Babelon, Reinach, Müntz, and de Marsy, of Paris; de Rossi, Marucchi, and Helbig, of Rome; Hildebrand of Stockholm; Lambros of Athens; and many more. Many of our countrymen are also enlisted in the enterprise.

With such an array of names, a good series of papers would of course be expected, and the result has been satisfactory. In the latest number the most noteworthy article is, perhaps, that of Professor Merriam, on that remarkable code recently discovered at Gortynia in Crete. So long ago as 1857, an inscribed stone, built into the walls of a mill on the banks of the Cretan river

Lethaios, was discovered by M. Thenon, and afterwards transferred to the Louvre. Its meaning was deciphered by M. Bréal in 1878. In 1884, Halbherr, a pupil of Comparetti, discovered on the same site four columns, with additional parts of the inscription. A few months later eight more columns were disclosed by Fabricius. Dr. Halbherr returned again last summer to his task, but no additional inscriptions were found. The text thus gradually brought out is now printed with a translation, and with critical comments, by Professor Merriam, who comes to the conclusion that the inscription is probably of the period of Solon. Our space will not permit a fuller account of this wonderful monument, interesting not only to archeologists, but to students of historical law and the history of civilization. Professor Merriam is to continue his discussion in the following number of the journal.

S. Reinach, lately in the French school at Athens, describes a beautiful statue of Artemis, lately discovered, and now in the *Tchinley-Kiosk* museum in Constantinople. The editor, Dr. Frothingham, has an illustrated article on the revival of sculpture in Europe in the thirteenth century, and begins a series of notes on Christian mosaics. The other main article is by Mr. W. H. Holmes, on the monoliths of San Juan Teotihuacan, Mex. Our notice would be incomplete if it did not include a reference to a second article by Reinach on the base of an archaic bronze statue from Mount Ptous, which has an interesting and enigmatical inscription. Babelon's article, running through fifteen pages, on Greek and Roman numismatics, is also full of interest. But, valuable as are all these special papers, many readers will find still greater advantage in having at command, in a single number of this journal, forty-three pages of archeological news from all parts of the world, including fresh intelligence even from Cambodia and Hindustan.

GEOGRAPHICAL NOTES.

Color-sense of the Fijians. — Schwarzbach writes from Sydney in regard to the color-sense of the Fijians, which he has been investigating. They have no abstract word for color, but merely color-names. They have one name for black, which also includes all shades of blue, one for red and reddish tints, for white, for green, and for yellow. When asked to define more exactly some intermediate tint, they use some such phrase as 'it is like a bird.' Having examined over two thousand Hottentots, Malays, Melanesians, Australians, Maoris, and Polynesians for color-blindness, not a single instance was found; and the writer believes it to be confined to the white race, and a defect due to influences connected with civilized life.

Some local dialects. — Pinart states that the use of the Aino tongue on the Kurile Islands, already affected by the Aleut population brought there by the Russian fur company, has become practically extinct except on Iterup and Urup, the two principal islands. Since the cession of the group by Russia to Japan, the influx of Japanese has been such as to greatly dilute the already sparse population; and it is also said that on the island of Yesso the use of the Aino tongue is rapidly declining, while mixture of blood by marriage with the Japanese is on the increase. The same authority announces that in the midst of the mountains of the Sierra Tutotepec, in Mexico, especially at the village of Huehuetta, is a tribe known as the Tepehuas, or mountaineers, but who call themselves Ulmeca. These people, M. Pinart believes, speak a dialect essentially similar to the Totonak, and are probably the last remnant of the Olmek people referred to by early writers. There are about four thousand of them, and their manners and customs are peculiar in many respects.

Slavery in Madagascar. — In connection with a discussion of the condition of society in Madagascar, some interesting details have recently been made public in regard to slavery on that island. It appears that somewhat more than half of the population of four millions are in a state of servitude. Though the slave-trade has been prohibited, and the individuals brought from Mozambique for sale have been freed by royal edict, there is still in the outlying districts a surreptitious trade in slaves, supposed to amount to several thousand per annum. Of the people recognized as slaves there are two classes, — those of the Hova race, who have become so by the action of law, which prescribes slavery as a punishment for various misdemeanors and for bankruptcy; and the Andovos, who are prisoners of war taken in the conflicts between the Hovas and other indigenes. There are no plantations, and field-work as a regular labor is almost unknown. The free Hovas are not permitted to marry slaves; and, on the other hand, those of the slaves who have become so on account of debt, etc., are not permitted to marry among the Andovos, who are regarded by them as much their inferiors. Slavery with the Hovas takes mostly the patriarchal form. Apart from those employed as workmen or domestic servants, many are practically free, only being required to pay tribute, as of a fagot, for instance, on the Hova New-Year. Those who live with their masters eat at the same board, converse freely with them, and frequently use such terms

of address as would be literally appropriate only from children of the master of the house. Many have houses and farms of their own, giving a share of the crop to the master, who can, but rarely does, claim the whole of it. Slaves can use their earnings to buy their freedom if they can accumulate enough to do so, and they are frequently owners of other slaves. They generally make their own bargains for wages if they go out as porters or domestics, and reckon with their owner themselves. The condition of the slaves is much harder, however, among the Sakalavas, in the north-east part of the island, — a tribe hostile to the Hovas, and still pagans, by an alleged treaty with whom the French have acquired those 'rights' which they have for some years been vainly endeavoring to enforce upon the Hovas. With the latter, since their conversion to Christianity, a gradual and important amelioration has taken place in the matter of slave-holding, and the families of criminals are now no longer liable to be sold into a state of servitude.

ASTRONOMICAL NOTES.

The zodiacal light. — Professor Searle of Harvard college observatory, in a paper recently published, has continued his interesting investigations on the zodiacal light. This peculiar phenomenon is supposed to be due to finely divided matter of some kind illuminated either by direct sunlight or by the result of electrical or chemical action. This matter may be only a portion of the atmosphere or of some cosmical mass more or less homogeneous, but illumination is presumed to be confined within certain limits; and the difficult task of the observer has been to attempt to define these limits. As a result of the present inquiry, there would seem to be reason to think, that after allowing for atmospheric absorption, which probably affects the apparent position largely, the zodiacal light, as seen during the second half of the nineteenth century, has had a more northern latitude near the longitude 180° than near the longitude 0°. Furthermore, from a careful study of the distribution of the stars in the Durchmusterung, Professor Searle shows, that, "upon the meteoric theory of the zodiacal light, it is to be expected that a continuous zodiacal band should be present; but the question of its actual visibility is complicated by the slight maxima of stellar density which are situated along those parts of the ecliptic most readily accessible to observation from stations in the northern hemisphere." And finally, from an examination of the elements of the first 237 asteroids, it would seem that the belt of sky occupied by the projections of their orbits presents certain peculiarities which correspond to those of the zodiacal light, and suggest the hypothesis that the light may be partly due to minute objects circulating in orbits like those of the smaller planets.

U. S. naval observatory. — Vol. xxix. of the publications of the Naval observatory, now in press, will contain, in addition to the regular series of astronomical and meteorological observations for 1882, a valuable appendix by Professor Hall on the orbit of Iapetus, the outer satellite of Saturn; an appendix by Professor Harkness on the flexure of transit instruments; and a third appendix by Commander A. D. Brown, giving the observations of the partial solar eclipse of 1885 March 16, made at the observatory, and also observations made by several volunteer parties near the line where the annular phase was visible.

Lord Rosse's observatory, Birr castle. — We have recently received two papers communicated by the Earl of Rosse to the Royal Dublin society, and reprinted from vol. iii. (second series) of the Scientific transactions of the society. The first of these papers is a series of notes by Dr. Boeddicker, on the aspect of the planet Mars in 1884, accompanied by a lithographed plate giving thirteen sketches of the markings on the planet's surface. The second paper is also by Dr. Boeddicker, and contains the results of observations made on the changes of heat from the moon during the total eclipse of 1884 Oct. 4. From these observations it would appear that the amount of heat radiated to us from the moon itself, as distinguished from that merely reflected or diffused by it, is almost insensible; and the minimum of the heat effect falls decidedly later than the minimum of illumination.

NOTES AND NEWS.

FOR many years the exorbitant tax on salt in India has oppressed the lower classes, almost extinguishing some branches of industry. The Indian government has at last become alive to certain objections to the present rates of the salt-tax; namely, that cattle are stinted of a supply of salt, and that the same duty is charged on salt employed in manufactures or agriculture as for that used for other purposes. Experiments, for some time unsuccessful, have been prosecuted with a view of discovering a process whereby salt, while still useful for manufactures and agriculture, could be rendered unfit for human consumption. The government has now offered a reward, not exceeding five thousand rupees, to the inventor of a process satisfying the following condi-

tions: first, that its cost shall not exceed four annas per eighty pounds: and, secondly, that the preparation shall be such that edible salt cannot be extracted from it by the ordinary processes used by native salt-workers.

— The vaccine from revaccinated children is of doubtful protective potency, according to the observations of M. Blot, recently reported to the *Académie de médecine*.

— According to *La nature* of Jan. 2, an interesting ethnological discovery has just been made at Dampont, near Paris. An ancient burial-place of the polished-stone age has been there exhumed, and found to contain various portions of skeletons, implements, pottery, etc. Three crania had been trepanned, and so skilfully that it appears like the work of a surgeon.

— Within late years surgical operations upon the stomach for the extirpation of tumors or the removal of foreign bodies have been attempted a number of times, but almost invariably with unfavorable results. A case, the second on record, is just reported from England, where a large mass of hair, weighing about a pound, was removed from the stomach of a young lady, through an incision five inches in length, with recovery.

— Two editions of Coulter's 'Rocky Mountain botany' (New York, *Ivison, Blakeman, Taylor & Co.*) are offered to the public: one of them is uniform with Gray's manual of the botany of the eastern United States; the other is printed on thin, strong paper, and bound in a flexible and durable cover for the needs of the tourist. Of the merits of the work, it is of course too early to speak. The special descriptions which have been carefully and laboriously brought into a compendious arrangement for practical use by every day students, must now be subjected to criticism in the fields and parks, and on the slopes of the mountains of the central chain. It will not be surprising if some of the work done in the study will have to be modified by repeated examinations of the specimens in their homes. But, so far as a careful inspection of the attractive pages of this volume can at present show, the work has been conscientiously and thoroughly done, and is a substantial boon to our students of botany.

— The preparation of a new geological map of France, on the scale of 1:[illegible], has been undertaken by Messrs. G. Vasseur and L. Carez, according to *Comptes rendus* of [illegible] '28. The first parts have been already presented to the academy. The work will comprise forty-eight parts and will require five years for its completion. [illegible] plates are already printed, mostly of the northern regions. Each large stratigraphic group will be represented by a single color, with shadings for the subdivisions, as proposed by the international congress at Bologne. The work will be accompanied by a volume of explanatory text.

— The university of Basle, Switzerland, possesses a human skeleton, prepared in 1543 by the founder of anatomy, Andreas Vesalius. It is the only known relic of this greatest of all human anatomists; which fact, together with its great age, makes it especially precious. In the times of Vesalius the dissection of the human body was permitted by the authorities only with the greatest reluctance; and the history of the present skeleton, as recently given by Professor Roth, is particularly interesting. On the 12th of May, 1543, the body of one Jacob Karrer, who had been beheaded, was handed over to the university for dissection by Vesalius. Not for two years had such an opportunity occurred, and one can imagine the interest with which for many days the students and teachers followed the words and demonstrations of the great master. At the completion of the dissection the skeleton was prepared by his own hands, and presented to the university. It was in this year that his great work on human anatomy, the foundation of the modern science, appeared. Who knows how much we are indebted to this very subject for the discovery of much that is taught to-day, — discoveries for which the author was condemned to death, and escaped only to die in exile from starvation?

— The trustees of Cornell university have filled the newly established Sage professorship of ethics and philosophy by the election of Prof. J. Goold Schurmann, Ph.D., at present professor of philosophy at Dalhousie college, Halifax, N.S. Professor Schurmann is thirty-two years of age, and has studied at London, Edinburgh, and in Germany. As Hibbert travelling scholar, he collected the materials for an essay on 'Kautian ethics and the ethics of evolution,' which attracted some attention among specialists in philosophy when it was published, in 1881.

Prof. Charles E. Hamlin, of the Agassiz museum of natural history, died at Cambridge, Jan. 3, aged about sixty years.

Prof. A. M. Mayer, by the use of a simple form of vitroscope with electric registration of seconds, has reached some valuable and interesting results as to the conditions and limits of accuracy in this method for determining the rate of standard forks (*Mem. nat. acad. sc.*, iii.). He has also investigated the amount of change in the

rate of a fork caused by changes in temperature, in the amplitude of vibration, and by the pressure of the style against the paper on which the vibrations are recorded.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

An early prediction of the decay of the obelisk.

I GIVE below a translation of a portion of a letter from Dr. Alfred Stelzner of St. Petersburg.

"At first I wanted to add to my remarks a comparison between the New York Needle and the Alexander column in St. Petersburg; for the rock of both is very much alike: it agrees even down to the occurrence of handsome little zircon crystals. This comparison would have been made but that it would have been a mournful and unpleasant croak in the triumphant report of Mr. Gorringe, and therefore it had to be abandoned; but privately let it at least be put on record. You know, perhaps, that the Alexander column in St. Petersburg was transported from Finland to St. Petersburg in the thirties of this century at a senseless cost, and, with the assistance of thousands of men, was erected, — a monument for eternal ages, which should remind the beholder of a Russian monarch. But even in a few years the granite did sad honor to its Finnish name of 'Rappakivi,' i.e., the lazy-stone. The granite commenced to weather, and weathered merrily on in spite of all technical and scientific commissions; and one can well say that the years of the proud monument are numbered. It is possible that they chose unsound stone, and that they shook it about too much; so that, in quarrying and transporting it, it became filled with little clefts, and thus gave free play to its disintegration. But General Helmersen explains the affair differently. The granite, he says, contains many large felspar crystals. But the felspar is triclinic, and therefore expands, under the great differences of temperature between the St. Petersburg summer and winter, differently in the directions of its three axes: hence comes the crumbling, owing to the unequal molecular movement throughout the entire mass of the monolith. If this explanation is correct, then from the similarity of the rocks from Finland and Syene, and the great differences between the summer and winter temperature which exist also in New York, an unsuspected danger threatens the old Egyptian monolith, which has always hitherto stood in a mild and equable climate. Perhaps, also, it will succumb to the weakness of old age, for the London Needle of Cleopatra is said to be beginning already to crumble in its new home. You may regard this statement as pessimistic, but a knowledge of the experiences made elsewhere will not injure the New-Yorkers. Perhaps it will lead them to cover up the Needle there with bad conductors of heat during the winter, and thus preserve the venerable old stone monument. In any case, you will agree with me that this comparison should be taken into consideration; but it will not do to insert it into Mr. Gorringe's book, where it would produce a discordant tone. But it is worthy of consideration. . . . Thus I wrote in 1882, and I regret that I was not mistaken. But the children of the tropics, be they palms or granite columns, will not stand a northern winter in the open air. For the rest, one will interest himself now more than formerly in the observations which have been made in other places. I take the liberty, therefore, of calling your attention to the memoir by Struve: 'The Alexander monument and the Rappakivi. A contribution to the better knowledge of the Finnish granites. St. Petersburg, 1863–64.'"

F. R.

Sea-level and ocean-currents.

The recent important determination of the coast and geodetic survey, by levelling up the Mississippi valley and across to the Atlantic coast, that the mean level of the Gulf of Mexico at the mouth of the Mississippi is about one metre higher than that of New York harbor; and the similar result obtained by Bourdalone, by levelling across France, namely, that the mean level of the harbor of Brest is 1.02 metres higher than that of the Mediterranean at Marseilles, — furnish an interesting subject for study, and important facts for explanation by physical geographers. If, as it seems, the surface of the ocean is not level and at rest, what are the forces which cause it to deviate from a perfect level, and to have ascending and descending gradients in different parts, and currents running in various directions?

There are two principal causes for this disturbance of sea-level, — the one, the difference of level between the equatorial and polar regions, arising from a difference of temperature of the sea in the two regions; and the other, the deflecting force depending upon the earth's rotation. The first is the real cause of disturbance, the latter being simply a modifying influence of the effects of the former, which changes, or tends to change, the directions of motion, but does not give any addition of real force.

According to Mr. Croll (*Climate and time*), as deduced from the soundings of the Challenger expedition, if the water of the upper strata were prevented from flowing away toward the poles, the level of the ocean at the equator, on account of its greater temperature, would be 4.5 feet higher than the level at the parallel of greatest diversity of sea-water, a little beyond the polar circle. This greater upward expansion in the equatorial region, however, does not change the pressure at the bottom of the sea; and its initial effect is to give rise in the upper strata to gradients of pressure decreasing from the equator toward the poles. This causes a flow of the water of these strata from the equatorial to the polar regions, and this decreases a little the pressure at sea-bottom in the former, and increases it in the latter, and consequently gives rise to a gradient of decreasing pressure, and an under-current, from the polar regions toward the equator. Hence there is now an interchanging circulation, a motion of the water of the upper strata from the equatorial region toward the poles, a very gradual settling-down of the water in the higher latitudes, a return toward the equator in the lower strata, and a very gradual rising-up again in the lower latitudes.

If the earth had no motion of rotation on its axis, this would be simply a vertical circulation without any motion either east or west. But, in consequence of the deflecting force of the earth's rotation, the water of the upper strata, in flowing from the lower latitudes toward the poles, is deflected eastward; and it retains this eastward motion until it has settled down in the higher latitudes into the lower strata, and has returned, perhaps, to the parallel of 35° or 30°,

by which time the deflecting force due to the earth's rotation — always to the right in the northern hemisphere, and the contrary in the southern — has overcome the eastward motion, and it now begins to assume a westerly component of motion. Hence, where there is an interchanging motion between the equator and the poles, the effect of the earth's rotation is torsionary, tending to give rise to an eastward motion in the higher latitudes, and a westerly one in the lower latitudes; extending, where there are no interruptions from continents, all around the globe. The relation between these must be such that the action of the former, by means of friction on the sea-bottom, shall not have any greater tendency to turn the earth eastward on its axis than that of the latter to turn it the other way: for no change in the velocity of the earth's rotation can arise from the action of forces simply in the plane of the meridian, which are the only real forces here, those arising from the earth's rotation being simply modifying influences. Since the action by means of friction upon the sea-bottom in the higher latitudes, which tends to turn the earth from west to east, is much nearer the axis of rotation than that in the lower latitudes, which tends to turn it the other way, the eastward motion in the former is more rapid than the westward one in the latter.

In the real case of nature, in which a continuous motion either east or west all around the globe is interfered with by the continents, the tendency to such motions gives rise to various deflections by the continents. For instance: in the North Atlantic the tendency to flow eastward in the middle and higher latitudes causes a slight heaping-up of the water, and a rise of surface level adjacent to the coast of Europe, and a drawing-away of the water and a depression of sea-level along the north-east coast of the United States. As the water of the upper strata, however, is thus pressed over against the coast of Europe, its surface does not assume a gradient of static equilibrium; for the water, in consequence of the raising of the sea level on the coast of Europe, and especially of France, is disposed of in three ways: one part is deflected around to the left along the coast of Norway, around by Spitsbergen and the east coast of Greenland; another to the right, down by the Canary and Cape Verde islands in the region adjacent to the north-west coast of Africa; and a small part flows back westward under the upper strata as their water is forced eastward. The latter is small on account of the great pressure and friction on the sea-bottom, which does not have its counterpart in the upper strata.

It is important to inquire here what amount of motion of the water of the upper strata toward the pole, arising from difference of temperature between the equator and the pole, is required to cause, by means of the deflecting force of the earth's rotation, the necessary pressure toward the coast of Europe, and raising of sea level adjacent to it, to account for the observed difference of sea level between Brest and Marseilles, and the observed resulting currents. The gradient of the ocean's surface corresponding to any given velocity of the water in any direction, in the case of static equilibrium, may be obtained from the following little table, in which the gradients are given in feet per 100 miles, for a velocity of one mile in twenty four hours, the ascending gradient in the northern hemisphere being always at right angles to the right of the direction of motion:

Latitude.	Gradient.	Latitude.	Gradient.
	Feet.		Feet.
0°	0.000	50°	0.101
10	.023	60	.114
20	.045	70	.123
30	.066	80	.129
40	.085	90	.131

From this table, it is seen that a velocity of four miles per day of the water of the upper strata toward the pole, on the latitude of 45°, would cause a gradient of about 0.36 of a foot in 100 miles, or about 10 feet between New York and Brest, in case of a static equilibrium. But of course, for reasons already given, there would not be really this difference, — perhaps only about half of it; but this would be sufficient to account for the observed differences of sea-level between Brest and Marseilles, and the Gulf of Mexico and New York harbor; the surface of the ocean adjacent to the coast of France being about 25 feel above mean level, and that adjacent to New York as much below. The velocity above, of 4 miles in 24 hours, would give a very gentle and almost imperceptible current, and would not be at all greater than, as we have reason to think, it is.

We have, then, an ascending gradient from the north-east coast of the United States across to the coast of Europe, over which the water of the upper strata is impelled, until it arrives on the east side of the Atlantic, by the deflecting force arising from the earth's rotation and the poleward motion of the water of the upper strata. From the raised sea level here there is down-grade on the one hand, around by the north-west coast of Africa, across the Atlantic in the lower latitudes to the Caribbean Sea and Gulf of Mexico, and thence to the low surface-level on the west side of the Atlantic: and, on the other hand, around along the coast of Norway, and by Spitzbergen and the east coast of Greenland, to the same region of depressed sea-level; both tending to fill up the partial vacuum, as it is being continually maintained by the drawing-away of the waters, as explained above. The general descending gradient from the equator toward the pole, due to a difference of temperature, tends to decrease the gradient from the coast of France down by the north-west coast of Africa, and consequently the strength of the current; but the same increases the gradient and the strength of the current on the opposite side from the Caribbean Sea and the Gulf of Mexico. Hence the latter is greater than the former.

As a wide and gently flowing river, when it is contracted into a narrow pass, becomes a rapid stream, so the flow of the warm water from the Caribbean Sea and the Gulf to the region of depressed ocean surface adjacent to New York, being forced to pass mostly through the Strait of Florida, becomes, instead of a wide area of very gentle flow, as it would be if it were not for the West India Islands, and especially Cuba, a comparatively very narrow and rapid stream, 'a river in the midst of the ocean.' As this river of warm water flows northward, it tends, by the effect of the earth's rotation toward the right, and as the current from the east coast of Greenland flows southward it is likewise deflected to the right, toward the American coast. Hence, having very different temperatures, and being deflected to con-

trary sides, there is no tendency to mix together; but the division between the two, called the 'cold wall,' is nearly a vertical plane. This is the whole mystery of the Gulf Stream and of the cold wall.

The level of the Mediterranean Sea at Marseilles is undoubtedly a little lower than that of the Strait of Gibraltar and of the ocean generally adjacent to the north-western coast of Africa; so that the latter is about on a level with the western extreme of the Gulf of Mexico, there being a little down-grade across to the West Indies, and then a little ascending grade to the coast of Mexico to check the westward motion, and to deflect the current around toward the north. The difference, therefore, between the ocean-level at New York and Brest is probably about five feet.

There is another theory, the wind-theory, which is thought by some to explain satisfactorily all the currents of the ocean. It may be well to examine a little here the claims of this theory, and especially to consider whether it is adequate to explain the recently observed differences of sea-level. The westward component of the trade-winds, by this theory, raises the level of the Gulf of Mexico, and depresses the sea-level on the north-west coast of Africa as much; and the eastward and north-eastward motion of the air in the middle latitudes drives the water toward the coast of Europe, and so causes a depression of the sea-level on the American coast, and a raising of it on the coast of Europe. It is readily seen that this would give precisely the same system of circulation, and tend to cause the same differences of level between the Gulf of Mexico and New York harbor, and between the harbors of Brest and Marseilles, as the other theory. But it is well known that ordinary winds have very little effect in changing sea-level, except in very shallow water.

According to the Report of the chief of engineers (1876, part iii. p. 76), by the mean of all observations, the difference of mean level of Lake Ontario, at either end, with north-east, east, and south-east winds, and with south-west, west, and north-west winds, is only 0.05 of a foot, and hence the average effect of either class of winds on the surface level is less than one-third of an inch.

Again, if the trade-winds cause a raising of the sea-level in the Gulf of Mexico by a half-metre, they must depress the sea-level on the Pacific coast of Mexico about the same amount, and so there would be a difference of level of about one metre on the two sides. But by the levellings for the Nicaragua ship-canal, the elevation of the surface of Lake Nicaragua was found to be exactly 107 feet above mean tide of either ocean. Hence the trade-winds have no sensible effect in changing sea-level.

Furthermore, if the trade-winds can have so great an effect as is claimed for them, then the still stronger westerly winds, which usually prevail in the middle latitudes of the North Atlantic, should change the difference of sea-level between New York and Brest at least as much; and if so, there would have to be a considerable annual inequality in the height of sea-level; for the westerly winds are much more prevalent, and blow very much more strongly during the winter than during the summer season. There ought, therefore, to be a change of the height of sea level of more than one foot, higher in winter and lower in summer, on the east side of the Atlantic, and the reverse on the other. But no such inequality is observed on either side. Mean sea level is two or more inches higher, on both sides, in summer than in winter, which is evidently due to the difference of temperature of the sea-water in the two seasons, and there is no apparent effect whatever arising from an increase of the strength of the winds. The only inference from this is that the strongest winds have no sensible effect.

A continuous wind, for some time in any direction, evidently causes mere surface currents of considerable velocity; but if they could even explain the strong and deep flowing currents, such as the Gulf Stream, it is evident, from what is shown above, that they cannot account for the great differences of sea-level which have been shown to exist by recent levellings.

Wm. Ferrel.

Washington, Jan. 18.

Oil on troubled waters.

I do not know much about the sea, and so perhaps you will wonder the less at my expressing incredulity with reference to the reports of the extraordinary effect of 'oil on troubled waters,' to which you seem to give unqualified assent in your notes and comments of Jan. 15.

It is indeed remarkable that seamen should have overlooked this important aid to navigation, if, as you declare, its efficiency in calming the waves is as obvious as the use of the rudder in shaping a new course; for sailors are not usually slow to adopt notions favorable to the existence of prodigies and marvels.

But, if the newspaper accounts of the matter are to be believed, it strikes me that the hydrographic office has quite outdone every other politico-scientific bureau in the propagation of startling generalizations from very flimsy details. For example: one of its witnesses testifies that in 1863, when off Sydney Head, he encountered a terrific gale, followed by a tremendous sea, in which his ship was making water, and was in danger of wreck, and that he at first tried oil upon the waves by 'jerking it out' over the side of the vessel, through a hole in the cork of a bottle; but finding that when employed in this way it blew about the stem of the ship, and not into the sea, he made use of 'the oil-bag,' into which he put about half a gallon, tying the neck tight, and towing it astern. After a short time, he says, "the effect was wonderful; for what was a very heavy-running and dangerous sea was reduced, by the use of the oil, into what a seaman would call 'blind rollers,' quite harmless to a ship." He asserts that in this manner he ran his half-sinking vessel from Sydney Head to Port Stephens, a distance of sixty-eight miles, in eight hours and a half, on a consumption of two gallons and a half of oil, although he considers that his way of using it was wasteful. His subsequent experiences convinced him that a ship could run in any sea with safety for twenty-four hours on a consumption of five gallons of oil.

It is hardly surprising, that, as soon as the hydrographic office began spreading such sailors' yarns as this, other captains should have felt the necessity of keeping abreast of the times in nautical science by publishing their similar experiences. Accordingly the skipper of the schooner J. B. Atkinson announces, that, on the 25th and 26th of December, his vessel was saved from utter destruction off Cape Hatteras by bags of oil, which he also towed astern; and still later, the captain of the steamer Lucy P. Miller, running between Philadelphia and Nassau, writes to

the chief hydrographic officer that he, too, was in imminent danger in a heavy gale on the 26th of December, but that, having read what the hydrographic office had said about using oil, he "placed a bag in each closet forward, and let her go south-south-east," the effect of which was that he shipped no more water.

After all this, I should not wonder if some Jack tar, a little more imaginative than the rest, should outrun all competitors by reporting to the hydrographic office that he had quelled the raging deep merely by carrying a bottle or two of oil in the ship's locker; just as Hahnemann finally found that it was not necessary actually to take his medicine, but that, if the patient only smelled of the phial in which it was contained, it accomplished the same result.

Now, I should seriously like to know whether there is any more credible evidence that oil has a quieting influence upon the ocean than the kind of trash the newspapers are publishing as coming from the hydrographic office. C. F. COX.

New York, Jan. 18.

[Our correspondent assumes a very grave responsibility in trying to throw discredit on the efforts of the hydrographic office to render less dangerous the very hazardous vocation of the sailor. The efficacy of the use of oil to smooth the rough waters has been known for centuries, and the seamen of all countries have been in the habit of resorting to it when the necessity has arisen, although, for the reasons given below, not as freely as would be desirable. The evidence accumulated by the hydrographic office, through its branches in the seaboard cities, is the result of the first systematic attempt ever made by any government to collect such information, and to disseminate it, in the widest possible manner, among the class most interested. Many seamen have used it with success; and most, having heard of its value ever since boyhood, have always intended to use it on occasion. It must be borne in mind, however, that there is much to be done on board a ship undergoing all the vicissitudes incident to a gale of wind; and, unless the captain has had previous experience, he is not likely to think of experimenting when there is so much to do which he knows to be necessary. Seamen, also, though given to the telling of 'yarns,' are slow to believe them, a very harsh and trying experience making this class most incredulous and conservative.

The life-saving services of this country and Great Britain have made experiments with a view to demonstrating the usefulness of oil in quelling the surf. The results, however, have been unsatisfactory; yet this investigation led them incidentally into the subject of its usefulness off shore with most satisfactory results. The report to the superintendent of the U. S. life-saving service in 1883, of a committee appointed to examine this matter, states in conclusion, "The majority of the printed statements herewith, assuming them to be authentic, together with all verbal statements made by mariners who have used it, furnish conclusive evidence that in deep water oil has a calming effect upon a rough sea."

In an article published in the *Nineteenth century* for April, 1882, Mr. C. F. Gordon Cumming states that "it is now many years since I first endeavored to call public attention to the simple precaution." "Though the casting of oil on troubled waters has been so persistently regarded merely as a poetical figure of speech, notes of its actual use have occasionally appeared in books of travel;" and, again, "It has been reserved for the nineteenth century to find the practical application of the observations made by Pliny eighteen hundred years ago." The correspondent's confessed want of knowledge of the sea leads him very properly to make inquiries in regard to its 'prodigies and marvels;' but his sympathy should restrain him from decrying any attempt to benefit a class which, on the whole, gets a very small share of the substantial comforts of life.— ED.]

The following is a letter received at the Boston branch of the hydrographic office:—

On Nov. 28, 1885, I left Boston for London, deep with general cargo, and cattle and sheep on the upper deck. At 8.30 P.M. of Dec. 4 we were caught in a heavy storm at W. N. W., bar. 29 20. The first hour of the storm no canvass could stand it. In lat. 44° 38 and long. 48° 28′ W., ship running under bare poles, the sea was then so high and dangerous, I resolved to try the use of oil, having had it brought to my notice by information on your chart. I got two common gunny-bags and a good wad of oakum wrung out in paint-oil, and hung over each quarter, just dipping in the water, also one over by the scuppers in the midships. At 10 P.M. I got the lower topsail set, and continued to run until noon next day. By the racing of the engines my engineer reported to me that he could not run much longer, as the packing of the gland of the high-pressure engine was all worn out. I then got two more farther forward with a hand in each water-closet forward, dropping oil through; by this means she kept steady on her course, engines stopped, and sailing 6 knots, while the engineer did his work comfortably. I landed the whole of my cattle alive at Deptford, and never broke any of the cattle-pens.

The use of oil I strongly recommend in an emergency: a small drip is of no use. I used one gallon per hour, and had the watch continually going round attending one bag after another.

The result you know, and I hope it will be of use to shipmasters. KENNETH DOYLE, *Master*.

Furness line, SS. Stockholm City,
Boston, Jan. 17.

The Taconic controversy in a nutshell.

In *Science*, No. 153, Prof. N. H. Winchell, in writing under the above head, presents a very timely demurrer against the injustice done to the memory of Professor Emmons in ignoring the name 'Taconic,' and substituting 'Cambrian,' and several other designations, for pre-Potsdam formations other than Archaean.

In referring to recent studies of rocks that have been claimed as part of the Taconic by Emmons, Professor Winchell writes, "Some of the opponents of Emmons, re-enforced lately by active, younger men, revive the fossiliferous character of some of the eastern belts as new matter, adding many interesting and valuable details, and begin again to fire at the old fort long ago abandoned by Emmons, insisting that Emmons is still intrenched there (1872–85)."

I have several reasons for thinking that I have been understood to have taken a stand as part of the re-enforcement, because of my having recently published a paper on the subject mentioned, and entitled "On the occurrence of fossils in the 'Hudson

River' slates in Orange county, N.Y., and elsewhere."[1]

In this paper I described the finding of Trenton fossils in slates that Emmons had always considered to be of Taconic age; and Professor Mather's[2] statement that the remains of 'Testacea' were found at certain localities in these states appears to have been overlooked in Emmons's latest discussion of the subject (likewise in that of Dr. Hunt[3]). In calling attention to the nature of these remains, and adding a new locality, with descriptions of the structure of the beds, I was only presenting bare statements of facts; but, in consideration of the Taconic theory, I employed the words 'Fossils in the Hudson River slates,' etc., rather than 'Trenton fossils in the Taconian argillite,' in my title.

It can be readily understood how isolated patches of Utica slates could extend along the Hudson valley as far south as noted by Booth;[4] but my observations, together with those of Dale,[5] show the occurrence of Trenton fossils in beds at several widely separated points in the slate belt (I have discovered other localities since my paper), and point to the age of the great mass of these slates as post-Potsdam. An examination of the relations at Rock Tavern and at Sugar Loaf plainly proves that the fossiliferous beds are not isolated patches, and that neither are they superficial layers enclosed in synclinal folds, nor brought to their present positions by faulting.

In this connection it may be well to state that for some time the writer has been engaged upon a very detailed study of the structure of these slates, and the associated limestones and other formations. Many paleontological and stratigraphical discoveries have been made which will solve some of the problems of their ages and relations. A portion of the results of this work will be ready for publication early in the next summer.

NELSON H. DARTON.

Brooklyn, N.Y.

The temperature of the moon.

I hope that Professor Ferrel and I have no real ground of dispute: I may at least think so, since he does not deny that he begins by speaking of a certain body endowed by hypothesis with peculiar properties; such, for instance, as imply invisibility. Professor Ferrel, as I now understand him, explains that this implication is non-essential, and merely an analytical device to explain what would take place on a certain sphere, on which (by hypothesis still) the relative radiating and absorbing powers of every part are not merely proportional for any given ray, but to be safely treated as absolutely and without restriction equal, — a sphere on which, instead of physical approximations, we have absolute truths, which, like the axioms of Euclid, can be safely pushed to their extremest consequences.

This sphere it is my complaint that Professor Ferrel identifies with the moon, though it also seems to be a homogeneous body, not a world of irregular surface and structure; a body freed from changes of temperature, and which (unless infinitely conductible) would appear to need, not to alter its distance from the sun or rotate on its axis, — an absolutely airless body; and so on, through a really endless list of limitations, which we should find, on scrutiny, latent in his premises. *Under these limitations*, I do not dispute any of his conclusions; nor, when I say that no actual body in nature does exist under them, do I at all deny his right to consider one which by hypothesis shall do so, nor the interest of such an inquiry. I only call the reader's attention to the undoubted fact that the real moon exists under quite other ones. While I do not for a moment admit that the temperature of the real moon is independent of the amount of heat which it rejects by reflection, I can readily agree that it might be quite immaterial to the temperature of this hypothetical moon. I have no disposition to treat such an hypothesis as idle: I acknowledge its interest, and, I may add, its utility, if employed under clearly recognized limitations.

I recognize with respect the accuracy of the logical process always at Professor Ferrel's command; but, I repeat, the more accurate it is, the more certain it is to deduce only such conclusions as are implicitly contained in its premises.

Though he himself refers in part to these limitations at the outset, the general reader may certainly require to be reminded that they are not embraced in Professor Ferrel's conclusions, which may well be deduced from commonly made assumptions, by correct reasoning, as to a hypothetical moon, and yet not apply without limitation to the real one which we see waxing and waning in the sky. This is all I have to say, and I leave to Professor Ferrel the last word in this friendly controversy if he chooses to add it.

S. P. LANGLEY.

Allegheny observatory, Jan. 12.

Demand for good maps.

I am very glad that you have taken upon yourself to criticise our maps and the map-makers' methods, and sincerely hope that you may succeed in so stirring up the publishers that they will feel compelled to abandon the habit of servilely copying ancient, and ofttimes obsolete examples. I have been seriously inconvenienced at times, particularly when giving instruction in geography, by the outrageous carelessness, not to say gross ignorance, displayed by our leading cartographical institutions.

I heartily concur in what Mr. C. H. Leete says concerning the German maps. We are far indeed from their standard. Why is it? It is no exaggeration to say that the cheap German school-atlas, to which Mr. Leete refers, is much more reliable, and more nearly up to date, even in the geography of the United States of America, than the most expensive of our home productions.

Some years ago the travelling agent of one of our leading map-publishing houses called upon me, and insisted upon showing me their latest atlas, revised and corrected to date. I gave him every opportunity to explain the superior excellence of his wares, and, after he had had his say for over half an hour, I showed him that most of his maps were exact copies of those published from five to twenty-five years previously, the only apparent change being in the shades and elaboration of colors. Why, actually, though this was scarcely five years ago, the map of New York city showed the 'Crystal Palace'! Even where details appeared to fill in former blanks, more than one-third were mere guesses, and about as good

[1] *Amer. journ. sc.* (3d ser.), xxx. p. 452, 1885.

[2] Final report, 1843, p. 369.

[3] The Taconic question, Trans. Roy. soc. Canada, vol. i.

[4] *Amer. journ. sc.* (3d ser.), xxvi. p. 380, 1883.

[5] Ibid., xvii. p. 57, 1879.

guesses as the 'Golden City,' Colorado, to which you called attention some time ago.

J. KING GOODRICH.

Smithson. inst., Washington, Jan. 13.

Cliff-picture in Colorado.

The accompanying print is from a photograph of a remarkable formation which may be deemed worthy of mention. The original photographic print was sent to the military academy, about twelve years ago, by Capt. (then Lieut.) George S. Anderson, sixth U. S. cavalry. I have lately obtained from Captain Anderson the following statement in regard to the object. His statement is from memory, after the lapse of a dozen years; but it is not probable that there is any material error in it, as he went to considerable trouble to secure the photograph. The natural picture is on the face of the sandstone cliff forming the west bluff of the Purgatoire River, Colorado, twenty miles from its mouth, and twenty-five miles from Fort Lyons. The total height of the cliff at the point is about seventy feet above the bed of the river. The picture is about thirty-five feet above the stream, with twenty-five feet of vertical cliff above it. The talus of the cliff extends up about thirty feet, so that there are about five feet of vertical wall between the picture and the loose rock below.

The extreme length of the picture is at least seven feet. The cliff is composed of brownish-red sandstone: the picture at the surface is of a much darker color, which color gradually passes into the uniform color of the rock, at a distance of 2½" or 3" from surface, as shown by detachable fragments. Copies of the photograph were sent, at the time it was taken, to Prof. Joseph Henry, Professor Dana, and to Darwin. Professor Henry asked, "Can it be any thing else than a work of Indian art?" Professor Dana thought the color due to iron stains, and the outline accidental. Darwin hesitated to express an opinion, but dissented from Professor Dana. Colonel Kendrick, formerly professor at the military academy, expressed the same opinion as did Professor Dana.

The figure is remarkably distinct and well defined for the result of accident; but, if Professor Henry's idea be rejected, there seems no other explanation.

S. E. TILLMAN.

West Point, N.Y.

The English sparrow.

A European ornithological journal recently contained the following testimony in regard to the sparrow (Pyrgita domestica), from the pen of Dr. Schleh, professor of agriculture at the College of agriculture, Herford, Germany. Dr. Schleh has paid a great deal of attention to this matter, and believes the sparrow a pest on the continent, voluminous evidence of which he is said to have brought forward in his small treatise entitled 'Der nutze und schaden des sperlings (P. domesticus) im haushalte der natur.'

By examining the crops of a great number of nestling sparrows sent to him from different parts of the country, he found that young sparrows, while in the nest and for a week after having left it, subsist entirely on insects, grubs, etc. Two weeks after leaving the nest, their food still consists of 43 per cent of animal food; a week later of 31 per cent, and after that age of only 19 per cent, of animal ingredients. But as soon as they become independent of their parents, they prefer seeds, and subsist almost entirely on grain, fruit, and the buds of trees. Dr. Schleh, however, mentions some interesting instances regarding some specimens which seemed to have a peculiar taste for the seeds of weeds which often become a great plague to the agriculturist. In one crop he found the considerable number of 321 whole seeds of Stellaria media (Vill.), in another 43 seeds of Atriplex patulum (L.), in a third 66 seeds of Setaria verticillata. Some individuals also have a special liking for certain insects. Thus he found in one crop 90 specimens of Haltica affinis (Gyll.): four other sparrows had eaten almost nothing else but a certain kind of beetle, Anisoplia fructicola (F.).

ERNEST INGERSOLL.

Equality in ability of the young of the human species.

The review of a recent work on geometry, in *Science*, Jan. 1, is very justly criticised by W. R. in the number for Jan. 8.

Nothing is more fallacious than that ancestors have much to do with natural endowments: environment has much, and pre-natal influences probably most of all, in determining mental qualities. Physical traits are to some extent traceable to ancestry; but the whole history of the race, and of our country in particular, is a refutation of the much studied hereditary genius, or transmitted mental quality.

Even the writer's comparison is unfortunate. Nothing seems more like chance than the development of a race-horse. When the truth is known of our most celebrated mile-in-two-fourteen trotters, they will be found to have been picked up here and there from the peddler's cart or from the farm. Their qualities accidentally discovered, and fictitious pedigrees made up for them, they have never left a racing progeny behind them.

I fully agree with N. E. in saying, "Better assume that the young are born equal in ability, and in their early training . . . give them an equal chance to develop into mechanics, store-keepers, artists, farmers, or lawyers;" but by all means give them a chance to follow the bent of their intellect as soon as they are old enough to differentiate it, as, for instance, in their college courses.

P. J. FARNSWORTH.

Clinton, Io., Jan. 12.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 22, 1886.

THE COLLAPSE OF THE THEOSOPHISTS.

THE greater part of the last number of the Proceedings of the Society for psychical research [1] is taken up with the report of the committee appointed to investigate the famous Theosophical society.

For the information of those of our readers who have not followed the history of this society, a brief explanation will be necessary. The Theosophical society was formed in New York in 1875, by Colonel Olcott and Madame Blavatsky, for, it was asserted, philanthropic and literary purposes. Three years afterwards its seat of operations was removed to India, and among the better class of natives it seems to have gained not a few followers.

The evidence adduced before this committee of investigation — which included Prof. Henry Sidgwick and Messrs. F. W. H. Myers and Edmund Gurney — claims the existence in Thibet of a brotherhood whose members have acquired a power over nature which enables them to perform wonders beyond the reach of ordinary men. Madame Blavatsky asserts herself a *chela*, or disciple of this brotherhood, the members of which are spoken of as mahatmas, who are said to have taken a great interest in the Theosophical society, and to have performed many marvels in connection with it. They are said to be able to cause apparitions of themselves in places where their bodies are not, to communicate intelligently with those whom they thus visit, and to perceive what is going on where their phantasm appears. This phantasmal appearance the theosophists denominate the 'astral form.' The theosophists also brought forward evidence in support of another class of phenomena, including the transportation, even through solid matter, of ponderable objects, including letters, and of what the theosophists regard as their duplication, together with what is called 'precipitation' of handwriting and drawings on previously blank paper.

Because of the peculiar nature of the evidence, and the great improbability of the production of the alleged phenomena, it was decided to send a trusted observer to India, who should make a thorough examination of the persons involved, and of places in which these remarkable occurrences took place. Therefore, a member of the committee, Mr. R. Hodgson, B.A., of St. John's college, Cambridge, proceeded to India in December, 1884, and carried on his investigations for three months.

On hearing Mr. Hodgson's report, which is appended to the report of the committee, and carefully weighing all the evidence before them, the committee unanimously reports: —

"1. She [Madame Blavatsky] has been engaged in a long-continued combination with other persons to produce by ordinary means a series of apparent marvels for the support of the theosophic movement.

"2. That, in particular, the shrine at Adyar, through which letters purporting to come from mahatmas were received, was elaborately arranged with a view to the secret insertion of letters and other objects through a sliding panel at the back, and regularly used for the purpose by Madame Blavatsky or her agents.

"3. That there is consequently a very strong general presumption that all the marvellous narratives put forward as evidence of the existence and occult power of the mahatmas are to be explained as due either (*a*) to deliberate deception carried out by or at the instigation of Madame Blavatsky, or (*b*) to spontaneous illusion, or hallucination, or unconscious misrepresentation or invention on the part of the witnesses."

And, as the committee regards it as a waste of time to further prolong the investigation, many sober-minded readers will regard it as a foolish waste, that so much time has been already spent in the matter. But it must be recollected that this society was gaining ground and support, and was imposing on thousands of impressionable and credulous people. To them it is a real act of benevolence that this bubble has been pricked once and for all, and in a scientific way. As to Madame Blavatsky, a mere reading of the pages of evidence compels an agreement with the committee, who say, in conclusion, "We regard her neither as the mouthpiece of hidden seers nor as a mere vulgar adventuress: we think she has achieved a title to permanent remembrance as one of the most accomplished, ingenious, and interesting impostors in history."

In addition to the report of this committee, of which the preceding is a summary, this volume of

[1] *Proceedings of the Society for psychical research*, part ix., December, 1885. London, *Trübner*, 1885. 8°.

the Proceedings contains an interesting essay on 'Some higher aspects of mesmerism,' by Messrs. F. W. H. Myers and Edmund Gurney, who treat of the existence, limits, and varieties of mesmerism as a therapeutical agency; and a further report on 'Thought-transferrence,' with numerous statistics and diagrams, by Malcolm Guthrie, J.P. While many of Mr. Guthrie's experiments are novel, and as a rule more difficult than usual, yet they are of the same general character as those with which those who have followed the progress of the societies for psychical research, both in England and in this country, are already familiar.

NICHOLAS MURRAY BUTLER.

GIANTS AND DWARFS.

THE above title is prefixed to a series of articles[1] recently published, but is, however, somewhat misleading. What is attempted is, not the consideration of the causes and consequences of abnormal deviations in height in the human species, but a presentation of the differences resulting from the absolute size of an animal, — a sort of 'animal mechanics,' which, in the author's opinion, is to become an important chapter of morphological science. The speculations presented are not without some value and considerable ingenuity: but they are characterized by a passion for reducing every thing to mechanical terms in a way which does not fit biological facts; by a peculiar anthropomorphic point of view, which gauges the actions of animals as though the animals were men; and by an avoidance of evolutionary principles, which one would think would be especially important in this connection. Perhaps it will not be altogether without interest to sketch very briefly the author's methods and his conclusions.

If a body is ten times smaller in one dimension, say in height, than another, and is to retain the same shape as the first, all linear dimensions will be reduced to 1-10, all surface dimensions to 1-100, and all solid dimensions to 1-1000, of their size in the original body. For brevity's sake, we will call an animal of average size a meso-animal (*Me*); an animal 1-10 as large will be a micro-animal (*Mi*); one 10 times as large, a macro-animal (*Ma*). Keeping these statements in mind, we will review the differences which would be caused in the several vital systems by a reduction of an animal to 1-10 its size.

Beginning with the skeleton. We will measure the strength of a bone by the multiple of the weight of the animal necessary to crush it. Now, as the strength of a beam (the bone) varies (1) as the square of the thickness, (2) directly as the breadth, (3) inversely with the length, if the bone is reduced 1-10 in length, breadth, and thickness, it can carry 1-100 of its former weight, while it has been reduced 1-1000 in volume; i.e., it is relatively 10 times stronger than the large bone. If the tooth of a meso-dog can just bear the dog's weight, then the tooth of a micro-dog can carry 10 micro-dogs; or, if it is to carry its own weight, it can become 1-5 smaller in cross-section. The smaller an animal, the more tender, weak, and soft may its skeleton be to satisfy its needs. This principle accounts for the presence of teeth in micro-animals of such a shape as would be useless in meso-animals.

Next the muscles. If 1,000 micro-animals were to jump against one meso-animal, each *Mi* would jump as high as the *Me;* for relatively equal muscles, with a single contraction, do relatively equal work. But altogether they will do absolutely as much work as the *Me.* The jump will depend on the ratio of the muscular system available for jumping-purposes to the whole body. A thousand small muscles will lift 10 times as much as one muscle 1,000 times its weight. Moreover, the small muscles would contract quicker than the large one. If one meso-man can throw stones the size of his fist for a distance of 50 of his own steps in 1 second, then a micro-man could throw stones the size of his fist for a distance of 500 of his own steps in 1-10 of a second. A micro-girl would knit a stocking of an equal number of meshes in 1-10 the time required by a meso-girl.

Again, take walking. The vibration of the leg of the micro-man will take about $\frac{1}{3}$ $\left(\frac{1}{\sqrt{10}}\right)$ of the vibration-time of the leg of the meso-man. The small man will walk very rapidly; but, as fatigue depends on the number of contractions, he will tire easily, will be out of breath soon, and will have covered very little distance. If we reduced our man by 1-100, the walking would be so rapid as to give forth a low tone; and if to 1-1000, the vibration of his legs would give a shrill note. Hand-shaking would take the form of a gentle chirp. The micro-man is evidently at a great disadvantage in walking: this can only be remedied by giving him different locomotive organs and a different mode of locomotion. If we give him very long extra legs on each side, and put his body between them, he will be able to overcome the inertia of his body much more readily; he will be able to resist small shocks without shifting to a great extent the centre of gravity; and he will acquire a hopping gait, which is much better suited to small animals. In short, he will approximate the arthropod, in

[1] K. Fuchs, *Kosmos*, 1885, ii., Nos. 3, 4, 5.

particular the insect type. This proposition that the arthropod form is best adapted for small animals, and the mammalian form for large ones, is one of the points insisted upon throughout.

Amongst other differences are the following: The nervous impulses would be conducted to the centre in 1-10 the time, and his reflex movements and reactions would be quicker. A water-rat can see the blaze of a gun and dip under the water before the shot has time to reach it. With regard to warmth, it is shown that the body surface of a small animal gives off more heat proportionately than that of a large one: hence small birds have a thick covering, or, again, the small animals become cold-blooded.

But we will leave this part of the subject to consider what may be called a micro-psychology. Some rather curious conclusions are drawn with regard to the sense of sight. While the same amount of light will affect the retina of the meso- and the micro-man, nevertheless, owing to the difference in convergence of the two eyes (upon which depends the inference of distance), the micro-man will judge things to be smaller and nearer than the meso-man. His horizon would be much more limited, and in seeking an object he would be less apt to find it.

As to hearing. As micro-animals live in a condition where a constant noise is present, they acquire special organs for making loud noises, such as are found on the legs of some insects; while, of course, their hearing is less available to them than in the case of larger animals.

The general principle with regard to the nervous system is this: as the amount of nervous matter necessary to the needs of a small animal is proportionately much smaller than in a larger animal, such nervous matter becomes available for other purposes, and thus very fine sensibility to small physical variations, and the development of peculiar sense-organs, become possible. Eyes and ears are multiplied, touch-organs of various kinds become numerous, and there is more room for variability than in higher animals.

This theory makes it probable that small animals are endowed with a sensibility for fine discriminations of temperature, barometric pressure, moisture, and so forth, which is unknown to us; and thus we account for the observation that animals take cognizance of the approach of a storm before man does.

With regard to psychic life, the following statements will be of importance: the micro-animal procures its food for a given period with less trouble than a meso-animal, it builds its house in a much shorter time, it foresees natural changes much better, and its movements are quicker. The result will be far-reaching forethought by means of house-building and harvesting instincts. Any act desirable for the moment, the meso-animal will be apt to neglect on account of the bother of doing it. A man sees a spot on his writing-desk for years, and never cleans it up; he decides to learn by heart a table of constants which has to be looked up with trouble each time, but never does it. This dread of labor causes most kinds of neglect. But with the micro-animal the act follows the word; there is no trouble, and thus much annoyance and danger to health are avoided. In the case of approaching danger, say of a storm, a meso- and a micro-animal will act very differently. The meso-animal recognizes the danger only when it is near, is flurried and frightened, has no time to build a shelter, and must seek a chance one. The micro-animal knows that the danger is not very near, that he has ample time to build a shelter, and need not trust to chance. And thus we see why many of the smaller animals prefer to build a new nest, to protecting or finding an old one, it is so readily done. By arguments which it would be difficult to reproduce, the conclusion is reached that the train of thought of this micro-animal is related to that of the meso-animal somewhat as a minuet to an opera of Wagner's, or a frieze pattern to a painting by Kaulbach; also that his conceptions would tend to be mathematical and regular. But in general it may be said that in psychic life the meso-man would have the advantage of the micro-man.

This very partial account of these speculations will, perhaps, serve to show their general tendency. They certainly belong to a class of thinking which is rather foreign to recent thought, but bring with them a suggestiveness which makes the problem discussed a very interesting one. The most serious objection is that very little attempt is made to show that the theory fits the facts (which might easily have been done), and more attention is paid to select facts that seem to fit the theory. As particularly worthy of consideration, may be noted the argument that when proportionately less of a certain tissue is needed for actual sustenance of the animal, more of it becomes disposable, and is subject to variation. It would seem possible that some valuable facts might be attained by a careful experimental study of the problems suggested by these theoretical considerations; and while they will not be sufficient, as they have been to our author, to rear upon them a whole physiology, a whole zoölogy, and a whole psychology, they will do a unique service to science.

THE RACES OF BRITAIN.

It is the praiseworthy custom of the Welsh national Eisteddfod to offer prizes for essays upon some topic relating to the ancient national life. This has produced excellent results in many directions, especially in the encouragement thus bestowed upon ethnological studies. Among the substantial fruits of such competitions are to be reckoned an able study by Mr. Luke Owen Pike on 'The English and their origin,' and Dr. Thomas Nicholas's valuable treatise upon 'The pedigree of the English people,' which in 1878 had reached its fifth edition. To neither of these learned works, however, was the great prize awarded. It was bestowed upon an essay presented by Dr. Beddoe, the late president of the Anthropological society of London, which has just been published, in an expanded form, in the volume now before us.

Differing from previous works, like those just alluded to, and Professor Rhys's 'Celtic Britain,' which are principally based upon historical and linguistic investigations, this is made up, to a large extent, of tables, maps, and plates compiled from the author's personal observations on color and stature, conducted on a large scale.

Dr. Beddoe's system is founded essentially upon the belief that permanence of color of the hair and eyes is most indicative of racial differences. The opposite opinion seems to have prevailed, ever since the days of Galen and of Celsus down to quite a recent date, that the color of the hair depends simply upon temperature and latitude. Our author's method separates eyes into three sorts,— light, intermediate or neutral, and dark. This distinction is founded as much upon shade as color. They are further subdivided into five classes, in accordance with the color of the associated hair; viz., red, fair, brown, dark, and black. Thus is derived, as a ready means of comparing the colors of two peoples or localities, the 'index of nigrescence,' by "taking 100 of each, and subtracting the number of the red- and the fair-haired persons from that of the dark-haired, together with twice the black-haired." This gives a number which compendiously represents this tendency. The black is doubled in order "to give its proper value to the greater tendency to melanosity shown thereby; while brown (chestnut) is regarded as neutral." This method Dr. Beddoe believes to be preferable to that of Virchow, which notes only the percentages of the pure blond type (blue eyes and fair hair) and of the pure brunette type (brown eyes and dark hair), and pays but little attention to other combinations, which are regarded as results of crossing.

As a striking example of the great value of the color of the hair as a test of race, he instances one of the most distinct anthropological frontiers of Europe,— a real ethnic division along the line that separates the Flemish tongue, which represents a German stock, on the north, and the Walloon, descending from an ancient Belgic race, on the south. The difference in the physiognomy of the two peoples is very marked; but such tests as head-measurements and stature fail, while that of the color of the hair everywhere holds good. So, too, as proving that the color of the hair does not depend upon latitude and temperature, he brings forward the example of the occurrence among the dark-haired Italian race of two centres of comparative fairness,— one in the north-western part of the valley of the Po, the other in the region lying between Terracina and Naples.

But Dr. Beddoe had by no means confined his attention to observations upon the hair and the eyes. In the absence of "sufficient osseous material in the museums for determining the form and size of the skull," he has measured a considerable number of living British heads. He gives an amusing account of the way in which he obtained a series of head-measurements in Kerry, without running the risk of fatiguing or irritating the subjects. The people there have large heads, but are of low intelligence, with a great deal of cunning and suspicion. The travelling party consisted of four, and, "whenever a likely little squad of natives was encountered, the two archeologists got up a dispute about the relative size and shape of their own heads, which I was called in to settle with the calipers. The unsuspecting Irishmen usually entered keenly into the debate, and, before the little drama had been finished, were equally betting on the sizes of their own heads, and begging to have their wagers determined in the same manner."

So far as concerns the survival of the prehistoric races in Great Britain, Dr. Beddoe accepts the probability of Boyd Dawkins's theory that the paleolithic people were the ancestors, or at least the near relations, of certain still existing Mongoloid races, particularly of the Eskimo. In this opinion, however, he is opposed by the eminent Hunterian lecturer, Professor Flower, who, in his president's address, delivered last January before the Anthropological institute of Great Britain, argued that the Eskimo are probably of comparatively late origin, on the ground of their being such an intensely specialized race. But our author thinks he has sufficient ground for assuming the existence of traces of some Mongoloid race in the modern population of Wales and the west of England. He in-

The races of Britain: a contribution to the anthropology of western Europe. By John Beddoe, M.D., F.R.S. Bristol, *Arrowsmith*; London, *Trübner*, 1885. 8°.

stances in particular the examples he has noted of the oblique or Chinese eye, and of prognathism, or prominence of the jaws. The latter peculiarity, by itself, would not be of much value if it were not for the great similarity in other respects that exists among the individuals in whom it is manifested. But prognathism by no means implies a low type of humanity, and it is remarked by our author that eloquence, or at least readiness of speech, seems to be a general characteristic of it.

For the neolithic period, while accepting in a broad way Thurnam's formula, 'Long barrows, long heads; round barrows, round heads,' Dr. Beddoe cannot allow that this represents accurately the character of the entire population. He believes that the distinctive practice of dolmen-building was established in Britain by a pure long-headed race, while the broad-headed people were the introducers of bronze. "Whencesoever they came, the men of the British bronze race were richly endowed physically. They were, as a rule, tall and stalwart; their brains were large, and their features, if somewhat harsh and coarse, must have been manly and commanding." It has been objected to this type, that the great development of the brows, and the transverse furrow on the forehead above, are shared by the Australian and other savage races. But it is well established that such points of likeness as these to the anthropoid apes are distributed variously among the different races of mankind, and that no one of them, taken by itself, implies intellectual or moral inferiority. "Certainly," says Dr. Beddoe, "the British bronze type is found frequently — I should say with disproportionate frequency — among our best as well as our ablest and strongest men."

But at the bronze period the mass of the population cannot be regarded as belonging to this type. Their skulls present a shape intermediate between those of the long barrows, and those of the round barrows, — a form for which Wilson has proposed the name of 'pear-shaped,' and our author the one, not very satisfactory to himself, of 'coffin-shaped.' This type may be the result of a partial fusion of the two races, or it may have been imported, already made, by the very numerous invaders from Belgic Gaul. It has usually been styled the Keltic type, but Broca thinks that the name of Kelt ought to be restricted to the race that predominated in old Keltic Gaul, from Bretagne to Savoy. Their short, thick-set figures, and large, broad heads, are very different from the ancient British type, whose general distribution throughout the three kingdoms tells strongly against its being a late importation.

Such was the population of Britain at the time of the Roman conquest, composed of several strata, unequally distributed, of a Keltic-speaking race, some Bryothonic, others Gaelic, in dialect. This ancient British race belonged to the tall, blond stock of northern Europe, rather than to Broca's Keltic race; and they probably greatly resembled in appearance the provincials carved upon the sarcophagus of the Roman prefect Jovinus, — now preserved in the Museum of the Hôtel de Ville, at Reims, — who are conspicuously different in features from the modern Germans. This race was superposed upon a foundation principally made up of the dolichocephalic dark race of southern Europe, the so-called Iberian, which is still strongly represented in the north of Scotland and in Ireland; but no Germans, to be recognized as such by speech as well as person, had probably as yet entered Britain.

The Roman conquest, however, had no material effect in changing the character of the population. Far different was it with the Anglo-Saxon invasions that followed upon its abandonment by the Romans. The most important chapter in the volume is naturally devoted to a careful review of the various theories as to the origin of the different invading tribes, and to a thorough study of the evidence of all kinds that might tend to shed light upon the process of 'the making of England,' — ethnological and linguistic, as well as that derived from laws and social institutions. We have space to touch, and that only in the briefest manner, upon one or two of the points discussed.

Our author's researches are quite in accord with the conclusions reached by Senator Hoar in a paper read last spring before the American antiquarian society, in regard to the origin of the Yankee of caricature, the typical Uncle Sam, and Brother Jonathan, "with his long, loosely-set limbs, his sharp nose and chin, his high cheek-bones, his narrow shoulders and high head." Dr. Beddoe paints this Yankee portrait to the life, when he is describing the true Frisian type, to be seen in the people dwelling around the Zuyder Zee, who are very different in their appearance from their neighbors the Hollanders. He proves that differences existed, physical as well as dialectic, between the ancient Frisians and the Saxons; and he shows that the county of Kent was the first to be invaded by the Frisians and their neighbors the Jutes. So the main object of Senator Hoar's paper is to show the obligations of New England to Kent for much of its laws and social institutions, and the strong physical resemblance of the two regions. Dr. Beddoe also brings out the notable likeness between the people of Boston, in Lincolnshire, and the frequenters of the Antwerp market. In no considerable town in England is the index of nigrescence so low. In one

particular, however, Dr. Beddoe differs from Senator Hoar; that is, in respect to the origin of the custom of gavelkind, by which the land of the father descends to all his sons in equal portions, — a custom adopted by our ancestors from the usage of Kent, and which has had a most important effect upon our history in fostering democratic institutions. Our author believes that this institution was derived from the Kymric branch of the ancient Britons, and not the Germans, and that the term can be best explained by the Welsh language.

Great differences of opinion prevail among recent writers as to the consequences of the Anglo-Saxon conquest of England, hinging mainly upon the degree of credibility attached by them to the statements of the old British chronicler, Gildas. Some hold with Freeman and Green that the ancient race was mostly exterminated; while Nicholas, and the Keltic school in general, are equally convinced that the British element predominates in the modern English people. Our author's conclusions upon this interesting subject may be summed up as follows: About the middle of the fifth century certain German tribes, invading the country, settled some districts almost exclusively, making serfs of some portion of the prior population, and forcing the remainder to the west and the south. They uprooted Christianity, and changed to a great degree the local nomenclature. But they adopted, or allowed to remain, many usages relating to the land, and they intermarried largely with the native women; so that their descendants exhibit changes in physical type which approximate them somewhat to the original inhabitants. In language the most important and necessary words, particularly among the verbs, are Teutonic; so are most of the grammatical forms and rules; and so, also, is the pronunciation.

The Danes, in the latter part of the ninth century, by their invasions, gave a strong Scandinavian tinge to the eastern counties of England, and made themselves exclusive masters of the islands around Scotland: in other parts of the country their influence is not marked.

But the Norman conquest, although it did not at once introduce any very large accession to the population, undoubtedly produced the type that is still the prevailing one among the upper classes of England. Our author finds, by an examination of the color-tints of portraits of the nobility, a prevalence of dark hues, even more marked in the sixteenth and seventeenth centuries than in the nineteenth. The severity of the conquest was chiefly felt in Yorkshire and parts of Lancashire, where the Anglo-Danish population was nearly destroyed. In other parts of the country no permanent change in the physical type or racial elements seems to have resulted from it. In this branch of his inquiries, Dr. Beddoe has drawn, principally from Domesday book and other mediaeval records, interesting and useful inferences, which we regret not to be able to quote.

We will conclude by calling especial attention to three exceedingly well executed plates, in which are represented living faces, which, in the judgment of our author, reproduce the various types of 'the races of Britain.' His remark about 'the singular beauty of the women of Devonshire' seems fully warranted. H. W. H.

THE CAUSATION OF PULMONARY CONSUMPTION.

SCARCELY four years have elapsed since the important discovery of the tubercle-bacillus by Koch was announced. Many then thought that the key to the various problems of pulmonary consumption was close at hand, if not in our actual possession. Certainly therefrom a new impetus has been received in the study of these problems, — an impetus that may eventually bring about their solution; but so far this discovery has added but little to our actual knowledge of the causation of this most insidious disease.

This bacillus is readily and definitely distinguished from other allied micro-organisms. It seems to be present in tubercles wherever found, and is usually apparent in the sputum of consumptives; in some few cases it is believed to have been detected in the sputum when no signs of the disease were discovered; and other cases are known where the most careful examinations have failed to detect them, though tubercles were unquestionably present. Still the evidence so far is only negative. We may, without doing violence to the facts, assume that the bacillus Kochi is a constant accompaniment of tuberculous disease. They are remarkable for their vitality: decomposed or even dried sputum containing them retains all the powers of the fresh microbe, even after months have elapsed. Inoculated into the tissue of animals, either in the fresh state or after cultivation, they almost invariably produce tuberculous disease, though never the ordinary chronic consumption, but quick consumption, or miliary tuberculosis, which is held to be distinct in its nature. From these facts the conclusion would seem self-evident that floating particles of dried sputa, or at least when freshly thrown off from the diseased subject, might easily enter the lungs of healthy persons, and reproduce the disease. Unfortunately clinical evidence does not support this *a priori* deduction. Recent observations demonstrate that food impregnated with tubercu-

lous matter will produce corresponding disease in the intestine and other abdominal viscera. A number of dogs, subjected for several weeks to an atmosphere surcharged with particles of sputa, became tuberculous, but the evidence is not convincing.

The possibility of tubercular inoculation has been known for years. To Koch is due the credit of discovering wherein the peculiar agency consisted.

The contagiousness of pulmonary consumption has been believed for more than a century, and still is accepted by many physicians. Dr. Hermann Brehmer, upon whose extensive work[1] the present article is based, warmly contests these views, and, it must be admitted, with ability. He, in brief, endeavors to prove that pulmonary chronic consumption is never produced by the bacilli, and is neither contagious, nor, strictly speaking, hereditary. As the director for more than thirty years, of a private institution for the treatment of consumptives, he has been able to study nearly twelve thousand cases, chiefly drawn from the better classes. Certainly conclusions based upon such ample clinical material are entitled to our consideration.

Though some adherents of the bacilli theory of contagion have believed that these organisms are directly hereditary, lying latent for a longer or shorter period, to finally take on activity, yet such a view seems wholly improbable, if not absurd. Thus it is apparent, in what is considered hereditary consumption, that that which is entailed upon the offspring of consumptive parents is not the disease itself, but merely the disposition to the disease, — the consumptive habitus. If such a predisposition exist, as it unquestionably does, wherein does the true causation lie? Not in the bacilli, for they merely find a soil already prepared for their reception, and isolation does not appear to affect the chances of such predisposed persons becoming diseased. A sound, healthy person never becomes infected by the bacilli, at least never in the form of chronic pulmonary consumption, and the possibility in any other is not yet proven. It is only those in whom a predisposition exists — a consumptive habitus — who acquire the disease. What, then, is the true causation of the ordinary phthisis? This the author endeavors to show.

He has shown from the researches of Rokitansky, and his own, that the lungs of consumptives are abnormally large, and the heart and abdominal viscera are abnormally small. Thus the lungs do not receive their due amount of nourishment, and become the foci of disease, where the bacilli readily and easily find a lodging-place. This view may appear startling, yet it seems well sustained. The flat-breasted person of consumptive tendency has the lungs, not small, as is generally supposed, but elongated and large; the heart not merely atrophied, but actually lessened in capacity and power. Thus the relation between the normal heart and lung is about one to six; but in many consumptives so great a discrepancy as one to twelve may exist. The relation between the lungs and heart may consist not only in the former being too large, or the latter too small, but both may be actually normal so far as size is concerned, and the evil be found in abnormally small pulmonary arteries. Not only does the heart show physical incapacity, but it is functionally weakened, palpitation always existing to a greater or less degree in consumptives. Whatever may be the exact relation between these organs, the result is invariably the same, — deficient nutrition to the tissue of the lungs. Rarely are the abdominal viscera enlarged, and almost constantly it is found that consumptives have never been hearty eaters. A person with large breast, and its accompanying small lungs, an enlarged and powerful heart, well-developed abdominal viscera, and a hearty appetite, rarely, if ever, becomes consumptive.

Here, then, is the ultimate cause of the disease, — impaired nutrition. This impaired nutrition may be the resultant of various antecedent causes. First, and most important of all, is that due to heredity or prenatal life. Instances are too numerous to require argument, that acquired peculiarities may be and are transmitted to offspring. Impaired vitality, from whatever cause it may be due, re-appears often in the child. When such impaired vitality consists in the predisposing abnormal correlation of lungs, heart, and viscera, the fuel is prepared that only needs the match to start into active flame. The question here is of the greatest moment, — Were the tubercle-bacillus no longer in existence, would tuberculous disease become extinct?

A predisposing cause of but little less importance is that of the exhausted vitality in the mother, due to too frequently repeated gestation, — a cause that not only affects children of later births, but retro-acts strongly upon the mother. Thus it is that the later descendants of large and numerous families are more disposed to consumption. Again: lack of nutrition in childhood, whereby the healthy and normal development of the alimentary and arterial systems is retarded, produces a like disposition.

Injuries to the lung, in some instances, have

[1] *Die aetiologie der chronischen lungenschwindsucht, vom standpunkt der klinischen erfahrung.* Von HERMANN BREHMER, sen. Berlin, *Hirschwald*, 1885. 8°.

been thought to be an exciting cause; but such cases are due, the author believes, to the partial stagnation of the blood in the lung. In such rare cases where the disease first appears in the right lung, the author believes it to be owing to some malformation or aneurism, whereby this lung receives a less quantity of blood than the left.

Dr. Brehmer gives a history of five hundred cases in full, — cases in the offspring of non-consumptive ancestry, of those suffering under scrofulous or allied evils, and cases due to heredity. Other interesting results are perceived from the study of these cases. An unquestionable inter-relationship appears between consumption, mental derangement, epilèpsy, and deaf-mutism. The researches of Professor Bell upon deaf-mutism have, the present writer believes, substantiated the relationship of this last defect with other defects, and also show its heredity. May not all these proceed from the same general cause, — the transmission from parent to child of abnormal or deficient organs, which are ultimately due to impaired nutrition or unfavorable environment? That such effects do not follow deprivation alone, is apparent. Too great culture or luxurious habits certainly seem to be exciting causes. How much they are owing to nervous influence is a problem of interest. It is a well-established fact that wild animals kept in confinement are especially liable to phthisis. The most highly bred strains of domestic stock are likewise prone to tuberculous disease.

That consumption is contagious in the ordinary sense of the word, the author emphatically denies. It is true that the bacilli are rarely found in the atmosphere, except in large hospitals, where many cases of the disease are treated; but the author contends that a person not predisposed may expose himself with the utmost impunity to the contagia without becoming infected. As an evidence, is adduced the fact that in Göbersberg, during the last forty years, many thousand cases have been treated; nevertheless, the mortality from this cause among the inhabitants of the place has actually decreased by about fifty per cent from that of the preceding forty years. A century ago, in Naples and in Portugal, legal enactments placed this disease under the most rigorous ban. It was looked upon and treated as one of the worst pestilential diseases, and every thing connected with it pronounced unclean and dangerous. For fifty-six years were these rigorous laws enforced, to the great discomfort of the people, but without result: there was no decrease in consumption. He disclaims the prevalent opinion that married people will contract the disease from one another. Indeed, according to his experience, it is very rarely indeed that both husband and wife die of consumption. It is worthy of note, however, that whenever facts seem to warrant the assumption of contagion between husband and wife, it is usually the wife who suffers.

The author believes that the operation of all these causes is such that morphological changes are brought about, enabling one years, even decades, in advance, to predict with great probability which members of a given family will be afflicted with pulmonary consumption, and which will remain healthy. When acquired peculiarities through generations have become fixed, then, and in this sense only, does pulmonary consumption become hereditary.

Should these views of the causation of consumption be sustained, the question of contagion, or rather non-contagion, in another decade will no longer be disputed, and then the possibility of the conveyance of phthisis from man to man, in any other way than by direct inoculation, will be looked upon only as a superstition. When such definite conclusions have been reached, we will at last be in a position to study rationally the all-important problem of prevention and treatment.

N. W.

AN important investigation into the chemical constitution of the venom of the Indian cobra (Naja tripudians) formed, says the *Lancet*, the subject of a paper read before the Royal society, on Dec. 16, by Dr. R. Norris Wolfenden. It has been alleged that the venom of this snake contains an alkaloid and a principle known as 'cobric acid.' Dr. Wolfenden has been unable to verify either of these assertions; indeed, he denies the existence of both substances. He further shows that the venom loses its power when the albuminous bodies are removed or otherwise rendered inert. Mixtures containing the cobra poison, when treated with metallic salts that precipitate albumen, were found harmless. Wolfenden, like Weir Mitchell and Reichert, has found three poisonous proteids in the venom. The largest quantity of proteid was a globulin that had asphyxiating properties; and a smaller quantity of syntonin, possessing similar properties, was also detected. A form of serum albumen existed in minute proportions, and this was ascertained to have remarkable powers, paralyzing small animals. It has been objected that the possession of poisonous qualities by a serum albumen is a unique fact, but Schmidt-Mulheim and Albertoni have found ordinary peptones to be toxic when injected into the blood, causing various nervous disturbances, lowering the blood-pressure, and preventing the coagulation of the blood.

SCIENCE.

FRIDAY, JANUARY 29, 1886.

COMMENT AND CRITICISM.

THE ATTITUDE of Professor Newcomb towards the alleged discoveries in regard to thought-transferrence is one of extreme intellectual dissent, and will necessarily accentuate the impression of exceedingly great conservatism, which already prevails in regard to the American society for psychical research. His presidential address was essentially a frank though delicate denial, not only of the results concerning telepathy claimed by the English society, but also of the utility of pursuing any investigations upon the subject further. There appear, however, certain flaws in his argument, which are sufficient to prevent one from bluntly adopting his conclusion. He places much emphasis, for instance, on the extreme rarity of thought-transferrence in the ordinary course of life, and implies somewhat sarcastically that it ought to be much more frequent. To a physiologist, however, the possibilities appear differently: it is quite conceivable that telepathic irritations are extremely feeble, and are accordingly usually completely obliterated by the ordinary and much stronger irritations of daily life; just as the feeble sensations from the stars are obliterated by sunlight, so that, as aptly remarked by Dr. Bowditch, a man conscious only during the day would not discover the stars. Again, he states that telepathy is communication between two minds without the intervention of any physical agency. This certainly cannot be accepted as a correct definition; for telepathy means communication through other than the usually known sensory processes, and there is nothing in the hypothesis to exclude all physical agencies. So long as the physicists have to acknowledge action at a distance of gravity and electric induction, it is certainly no dishonor to any intellect to accede to the possibility of the action at a distance of mind, sufficiently to consider that possibility worthy of investigation, even though he has little expectation (and most scientific men have very little) of a positive result. We have alluded to the weak points of Professor Newcomb's address: the two strongest points are in criticism of the work of the English society. He finds fault very justly with their failure to ascertain the influence of varying conditions on thought-transferrence; and he further makes the very acute observation that in the reproductions of the drawings, though the lines are faulty, they always join perfectly, as would be the case with the work of a poor draughtsman who could see; and this, too, in the drawings made blindfold. The inference, which Professor Newcomb refrains from making, is, of course, that the person did see, and there was some trickery. By way of general criticism of the English society's work, we may frankly say that it is like that of amateürs and enthusiasts, and bears the character of such work, especially because it fails to deal rigidly and skilfully with the problems as they appear to professional physiologists and psychologists.

THE TWENTIETH ANNUAL REPORT of the Massachusetts commissioners of inland fisheries gives some facts of interest on the fisheries of that state. In many places, where the culture of land-locked salmon had been deemed a failure, the fish has appeared in numbers. Of the river-salmon there has been an increased run in the Merrimack River the past year, and, were it not for the depredations that have been committed, the river would now be self-sustaining. In Maine the salmon-fisheries have been greatly increased, and the catch for the past season is said to be the largest for fifty years. Shad-hatching was continued at North Andover, with good results. The river was found to be full of male shad from one to two years old. These young males return with the mature females, while the females do not return till they are three or four years old. Owing to the prejudice that existed, the artificial hatching of shad was abandoned for several years, with the result, that, on the Connecticut River, the value of the shad-fisheries fell off more than fifty per cent on the upper waters, and twenty-five on the lower. The resumption of hatching, however, has prevented further decrease, and an improvement is expected next year. Hitherto but little has been done for the cultivation of the carp in Massachusetts, under the impression that the state was too far north for such to be successful. That the idea is erroneous is clearly shown by several large ponds in the state, already heavily stocked with this fish.

In the autumn of 1881, sixty-seven carp were placed in a pond near Worcester: they have grown and bred very rapidly, without especial care having been given to them; so that the pond is now full of fish from four to twenty-five inches in length, and weighing as high as sixteen pounds. The most important fact connected with the other fisheries is the decrease in the catch of some of the more valuable kinds, such as the striped bass, Spanish mackerel, and bluefish; the last especially has everywhere been found less abundant than in recent years.

A MOVEMENT is before congress to establish a commission to determine the feasibility and value of inoculation with the causative agent of yellow-fever as a preventive of that disease. Dr. Walcott, president of the American public health association, and Dr. Holt, president of the Louisiana state board of health, appeared before the senate committee on epidemic diseases last week in this interest, accompanied by Drs. Billings, Toner, and Smart, of Washington. It is proposed to establish a commission to go to Mexico and South America to investigate the system of inoculation of Freire and Carmona, whose experiments have proved so successful in those countries, and also to investigate the principles of Pasteur, Koch, and others, in their special application to yellow-fever. The proposed bill will be reported favorably to the senate, and there is strong reason to hope for similar action in the house. The plan offers the possible emancipation of the people living in yellow-fever districts from the dominion of a pestilence which frequently costs tens of thousands of lives and hundreds of millions of dollars.

THE EXTREMELY COLD WEATHER at the south during the present season has strengthened the popular impression that the region in question is subjected to greater ranges of temperature and a less equable distribution of rainfall than formerly. With a view of testing the correctness of this impression, the Alabama weather-service has collected from the early Spanish, French, and colonial records, a mass of references to the weather. This 'record of the weather' goes back to 1701, when it was recorded by one of the French officials resident in Louisiana, that "the water has been so intensely cold that water poured in a tumbler to rinse it froze instantaneously." The records of 1711, 1718, and 1723, refer to destructive floods in the lower Mississippi; and in 1782 a hurricane is reported in Louisiana which "destroyed the crops, resulting in extreme scarcity of provisions." A number of references to hurricanes are given in the record; but, in all probability, they were of the same local nature as the tornadoes of the present day. The record is published as 'Special paper of the Alabama weather-service No. 1,' and is evidence that the service is desirous of doing its share toward adding to the valuable meteorological literature of the day. The editor of the 'record' is, however, an historian as well as a meteorologist, as he opens his work with a sketch of the early history of the Gulf states, and, under the date 1736, says nothing of floods, cold, or winds, but does tell us of "Bienville's expedition through Mobile, up the Bigbee River to Old Town Creek, thence north-west to the Chickasaw villages a few miles north-west of Tupelo, where the battle of Ackia was fought and the French badly defeated. Near the same spot D'Andreville shared a similar fate in 1753; and DeSoto, in March, 1541, fared but little better." Is not this an unnecessary mixing of sciences?

"A DEBT OF $135,000 encumbers the Cincinnati zoölogical gardens, and it is announced that they must be sold unless the business-men of the city come to the rescue. A system of private subscriptions is proposed by the managers, whereby there is a faint hope of securing a longer lease of life." In such words is the announcement made in the daily press of the present condition and probable fate of the Cincinnati gardens. In *Science* of Nov. 13, we referred to the financial difficulties of the Philadelphia zoölogical garden. It is certainly greatly to be regretted that sufficient support cannot be obtained in this country for these institutions. Boston and Washington are anxious to have zoölogical gardens; but the projectors will receive little encouragement from the financial history of those now in existence.

IN VIEW OF THE RECENT announcement that the faculty of Harvard college has decided to again allow the students to take part in intercollegiate football matches, it is interesting to note the frequent cases of football accidents to which the *Lancet* calls attention. That paper states that on Jan. 11 an inquest was held at Bridgewater, England, on the body of William Poole, aged twenty, who came by his death from injuries received whilst

playing in a football match on Dec. 28. The deceased, who was playing a very fast game, slipped and fell, and at the same time received a severe kick, probably in the abdomen, while several other players fell upon him. His death resulted from hemorrhage, arising from injuries to the internal organs. The *Lancet* goes on to say, "If proof of this [the dangerous character of the game as played in England] be wanted, it is furnished by the fact that this is at least the third fatal accident directly due to football already recorded thus early in the season."

THE HEAVY MORTALITY among the Baptist missionaries in the Kongo country has led Dr. Prosser James to write a series of letters, embodying descriptions of the principal diseases of tropical countries. These letters are entitled 'Health on the Kongo,' and are intended for circulation among the missionaries and the station officials of the Kongo Free State. It is to be hoped that Dr. James has in this way contributed to the well-being of the voluntary exiles in central Africa. Mr. Stanley still persists, that, with care, a European may successfully resist the inroads of the malarial influences to which he subjects himself on emigrating to the banks of that river; and every particle of wisdom which it is possible to impart on how to travel in Africa, how to locate a station, how to eat, dress, work, and sleep, must be a god-send to the adventurers. It is just such information that the letters are intended to give.

AT THE LAST ANNUAL meeting of the trustees of the Mount Auburn cemetery of Boston, Mass., it was voted that the trustees consider the expediency of establishing a crematorium, or of adopting any other method of taking care of the dead so that the sanitary law shall not be violated. The committee appointed, consisting of Mr. Roger Wolcott and Dr. R. M. Hodges, report that the acts of incorporation of the cemetery only permitted interment. Cremation has been legalized by the legislature of Massachusetts during the past year, and the cemetery will be prepared to receive for sepulture the ashes resulting from the process of incineration, and would prepare depositories above ground, or columbaria in the hill-sides, for the reception and preservation of urns and other memorials. These actions of the legislature and trustees are worthy of note, as showing the wide interest cremation is now attracting in America, as well as in Europe.

RECENT PSYCHICAL RESEARCHES.

THE American society for psychical research held its annual meeting on Jan. 11 last, at Boston, the headquarters of the society. There has been a steady and rapid growth in the number of associates; and, as the various committees are now well organized and at work, it is hoped that the society will display still greater vitality in the future. This fair prospect has, however, been disturbed in one respect by the president of the society, Prof. Simon Newcomb, whose address was read at the meeting. He devoted his attention to the work that has been done upon thought-transferrence, especially by the original English society, and endeavored to discredit the investigations and conclusions published by the English committee. In brief, Professor Newcomb's position is, that the phenomena of thought-transferrence, as heretofore recorded, are very rare and quite unexplained. Now, they may be due, he says, either to an unknown law of nature displayed under conditions we cannot control, or else to special circumstances which are unknown to us. In the former case we might compare the phenomena with those of electricity, which were at first rare, obscure, and beyond our control. Professor Newcomb, however, turns all his arguments in favor of the second alternative; but, as briefly indicated in our comments this week, his logic is open to criticism. The length of the address precludes a fuller discussion of it before its publication.

Dr. H. P. Bowditch gave an informal account of some experiments, which indicated to a slight extent the power of reproducing drawings by thought-transferrence. Dr. C. S. Minot presented the results of an analysis of the figures obtained from the attempts to transfer the thought of a single digit from one person's mind to another's. It was noticed in the returns of experiments that there was one case in which the person guessed a larger number of digits correctly than was probable on mere chance. Now, it so happened that this person displayed the, presumably unconscious, habit of guessing the digits by skipping irregularly by two or three numbers from 0, 1, or 2, up to 8 or 9, and then back again. When, therefore, the thousand digits upon his record of guesses were tabulated, the result was obtained, that, upon the average, the fourth digit guessed by him before a 9 was 3.3; the third, 3.4; the second, 4.2; the first, 5.4. After a 9 he guessed down the scale with equal regularity. No other person showed this peculiarity: hence it was evident that this guesser had followed out his personal psychological bent, and had not been reading the mind of the agent, who had thought

of the digit to be guessed. This confirmed the conclusion otherwise reached, that this case of success, called case E in the first report of the committee on thought-transferrence, was the effect of coincidence. It was further shown that this same person had marked preferences for certain digits, as is seen in the following table : —

Digit	1	2	3	4	5	6	7	8	9	0
Number of times guessed	97	92	122	117	106	101	112	90	85	78

The order of preference then was, 3, 4, 7, 5, 6, 1, 8, 9, 0. Moveover, in this series, 532 odd numbers stand against 478 even ones. That the number-habit, or the tendency to guess certain digits over-often, is actual and constant, was proven by the fact that these idiosyncrasies were shown in each set of 100, although made at various times. Similar examinations of the digits guessed by other experimenters showed in every case a more or less marked and constant number-habit, distinct for each individual, thus giving more evidence that in every instance there had been an absence of mind-reading. Putting about 9,000 guesses by thirteen persons together, and averaging them, it was found that the digits are to be ranked in the following order of preference, which is certainly very curious: 3, 5, 4, 6, 2, 7, 8, 9, 1, 0. About as many prefer odd as even numbers; but most persons prefer one or the other. Thus one guesses 466 odd and 534 even, but another 526 odd and 574 even. It is evident that the power of unconscious habit extends into details the most minute, and plays a much greater *rôle* in our mental life than is commonly admitted.

Professor Royce, on behalf of the committee on apparitions, announced the completion of a circular asking for the communication of stories to the committee. The speaker's remarks well expressed the attitude of the committee, which is sufficiently unlike that of the corresponding English committee to deserve mention. The starting-point is the viewing of the experiences in question as actual psychological facts; in going further, the tendency will be, at least on Professor Royce's part, to study how far these experiences are governed by the dictates of folk-lore, and to eliminate those stories which belong in the already well-known class of hallucinations. The search for an objective basis for the experience, for a specific external cause, is incidental only, and must follow after the exclusion of cases explicable by folk-lore hallucinations, etc. The English investigators wish too obviously and too eagerly to demonstrate the objective foundation of apparitions, and so have quite omitted to subject their material to the study which must come first, if the work is to be sound. Apparently they already accept an apparition seen by several persons as a *bona-fide* ghost, at least very probably. It need hardly be pointed out that the position taken by Professor Royce is much higher, his attitude more scientific, than this. The result of the committees' labor will therefore be awaited with great interest.

The meeting closed with some remarkable experiments by Dr. William James, who mesmerized Mr. Carnegie, one of the committee on hypnotism. While the latter was in the trance, Dr. James told him he could not see the chairman, with the effect of rendering him blind to that officer. Placing a prism in front of Mr. Carnegie's eye, so as to produce two images on his retina, Dr. James asked what he saw. The answer showed that he saw only one chairman, and therefore remained blind to one of the two images. This is believed to be quite a new fact in hypnotism. To show that although the subject adopts any suggestions made to him as to his sensory images, no matter how false the suggestion, yet he has extreme delicacy of perception, the following experiment was made: the subject was made to see an imaginary photograph of President Cleveland on a blank sheet of paper: the photograph was made, in the subject's vision, to leave the sheet of paper and travel round the room; behind Mr. Carnegie's back the paper was turned upside down: the photograph was now made to seem to Mr. Carnegie to return to the paper, which was handed to him; he immediately turned it about to its previous position. Thus an hypnotic subject can be made to believe in a sensation which is unreal, and yet can distinguish between the two ends of a blank piece of paper. Of course, the interest of these experiments is genuine only for those who have faith in the honesty of the two gentlemen. Those who do not wish to believe, may remain agnostic; but even they have to submit to the truth when experiments are made with animals. It may be added incidentally that Dr. Minot, in his studies on the growth of animals, habitually, he informs me, hypnotized his hens upon the scale-pan to keep them still while being weighed, — a useful practical application of hypnotism.

V. P.

THE AMERICAN ENGINEERS' MEETING.

THE annual meeting of the American society of civil engineers was held in New York, Jan. 20–21. The last meeting of this society was held at Deer Park, Md., on June 24–26. At that meeting, it was reported, more business was transacted and more discussion elicited than at any previous convention of the society. It was a meeting in a

small, out-of-the-way place, and the opportunities for having a good time were insignificant. The meeting in New York was apparently of a different character, very possibly not less beneficial to the members. Wednesday was devoted to the routine business of the society and the discussion of papers; but on Thursday the members of the society took advantage of the invitation of the managers of the new Croton aqueduct, and made an excursion of inspection along the line of the work.

Two prizes were awarded at the meeting, — one for a paper by Mr. Elliot C. Clarke of Boston, on a report on cement tests; and the other to Mr. A. M. Wellington, for a paper on experiments on journal friction at low velocities. The committee on uniform standard time reported encouraging progress, and stated that seventy-one managers of railways in America have favorably considered the twenty-four o'clock system, and that the Canadian Pacific railway has adopted it, and has changed its time-tables, its clocks, and the employees' watches, to adapt them to the new standard.

At the last meeting, Prof. T. Egleston of Columbia college presented a paper on the cause and prevention of the decay of building-stone. At this meeting Professor Egleston had something to say in regard to the disintegration of the surface of the obelisk in Central park, and took ground similar to that of Mr. Arnold Hague, whose views were published in *Science* for Dec. 11, and held that the disintegration was due to the great changes in temperature to which the obelisk is now exposed, and that the coating of paraffine might arrest the decay, but that nothing short of housing would stop it entirely. He stated that granite will absorb about one per cent of moisture, but that he had found that specimens from the side of the obelisk in London will absorb over seven per cent, this increase being due to its disintegrated condition. So far as the paraffine keeps out moisture, and thus prevents the formation of ice in the cracks, it would aid in the preservation of the stone.

Dr. Rothwell exhibited a system for submarine tunnelling. The company which Dr. Rothwell represents is contemplating tunnelling the Northumberland Straits to Prince Edward Island, which is now often cut off from all communication with the rest of the world for a month at a time, on account of the ice.

The next meeting of the society will probably be in or near Denver. The officers for 1886 are: president, Henry Flad; vice-presidents, T. F. Rowland, T. C. Keefer. The secretary and librarian, John Bogart, was re-elected.

ACCESSIONS TO THE NATIONAL MUSEUM.

THE most complete catalogue ever printed of the Catlin collection of Indian paintings, now in the national museum, will shortly be issued, and will be profusely illustrated. The manuscript is now in the hands of the printer. This catalogue will form an appendix to the 'Report of the national museum for the half-year ending July 30, 1885.'

The national museum has recently received from Paris four life-sized models of Africans, executed by Jules Hebert, — a Wolof, from Cape Verde; a Bambarra, from the upper Niger; a Soumali, from Cape Gardafui; and a Masai, from Lake Victoria Nyanza. These models are clad in native costume, and form a very attractive group in the museum.

An interesting example of the manner in which the Eskimo amuse themselves is afforded by a collection of twenty-five ivory carved figures, made by Mr. J. W. Johnson at Fort Alexander, Alaska. The group represents the game, 'the tug of war.' Two Eskimo on a raised platform are pulling at a drum-hoop, each one trying to dislodge the other from his position. A group of musicians are playing instruments in the foreground, and the spectators are located on the sides, enjoying the fun. The effect is very spirited, and the whole scene exhibits rare ingenuity.

One of the old tally-sticks used by the bank of England to keep account of loans, before the present system of banking was invented, has recently been acquired by the museum. This specimen bears the date of 1776, and represents a hundred thousand pounds of a loan made at that time. The stick is about four feet in length, and notches are cut on both sides of it. The stick is then split, the government holding one half, and the creditor the other. It is impossible to make any change in the condition of the loan by either party, because the notches on the two sticks would no longer fit, and thus fraud would be detected.

WORTHLESS BAYONETS.

THE examination of bayonets at Aldershot has revealed a state of affairs which is disgraceful to the English war-office, and most discouraging for the public. Three regiments have submitted their bayonets to the test, — the first Royal Lancashire, the second West Riding, and the first Seaforth Highlanders. All turned out very badly, but the badness was not uniform. Out of 700 bayonets belonging to the West Riding regiment, 55 broke under test, and 180 were found soft and otherwise defective, giving an average of failures of a little

over 38 per cent. The Seaforth Highlanders were a little better off, 169 of their bayonets and some sergeants' swords being condemned. The Lancashire regiment had 600 bayonets examined, of which 223, or rather more than 37 per cent, were found to be unfit for use. Altogether 2,000 bayonets were tested, out of which 611 had to be condemned. This number, taken at random from the regiments which happen at the moment to garrison Aldershot, is sufficiently large to be considered a fair sample of the whole supply of bayonets to the British army.

The London *Times* reaches the very unpleasant conclusion that three bayonets in every ten, or, to be accurate, 3,055 bayonets in every 10,000, now in the hands of the British army in all parts of the world, will fail the English soldiers in the hour of need. Or, to put it another way, England, which spends such enormous sums upon its army, may reckon that it has at this moment an entire army corps supposed to be fit to go anywhere and do any thing, equipped with weapons which will double up like a pewter spoon under the impact of a fanatical Arab.

Nor is even this all. The public may be excused for entertaining some suspicions as to the quality of the bayonets which have passed the test. How many of them, the *Times* asks, have just escaped condemnation, and how many are in fact what they are in theory, and what the English government pays to make them, — the best article that can be produced alike as to material and workmanship? It would be decidedly curious were there no intermediate grades to be found between a first-class weapon and one visibly and unmistakably worthless. The probability is that there are many; and until there exist assurances to the contrary, much more convincing than any yet produced, men of business will be disposed to doubt whether the percentage of unexceptionable bayonets is as great as that of downright bad ones.

FARTHEST NORTH.

TAKING all things into consideration, the Greely expedition was the most unfortunate expedition that ever entered the Arctic. Newfoundland was scarcely lost to sight when the men began to grumble about their food. Before the Proteus left Lady Franklin Bay, the second in command quarrelled with his chief. Unfortunately he failed to catch the returning steamer, and remained to add a gloom to the terrible gloom of the arctic night, and to add one more to the useless sacrifice on Cape Sabine. He soon found a confederate in the naturalist, and the two rarely spoke to Greely and Lockwood, the other occupants of the officers' quarters. Kislingbury and Pavy are both dead. We hope that Major Greely will go to the bottom of this matter, and tell us the true cause of so much discontent.

Farthest north; or, The life and explorations of James Booth Lockwood, of the Greely arctic expedition. By CHARLES LANMAN. New York, *Appleton*, 1885. 16°.

The next great misfortune which overtook the expedition was the death by starvation of the greater part of the force, owing either to the criminal negligence, or no less criminal ignorance, of those who had the relief in charge. The bodies of the dead heroes were brought to this country; but, before they were laid at rest, a noisy celebration was held in honor of the survivors. All honor to Brainerd, to Greely and the rest, but surely they would have preferred to have had better taste displayed in the matter. And now one of the foremost men of that party, a man whose name will forever rank with that of Payer in the annals of arctic discovery, has been most signally unfortunate in his biographer. No doubt, Mr. Lanman, if he had taken the time and care, and had possessed the requisite knowledge, might have written a good book; but the haste with which the present volume has been stuck together is apparent on every page. What is still more to be regretted is the omission of facts and descriptions which would have been interesting and useful to those familiar with the story of arctic exploration. Nevertheless, Mr. Lanman has printed many passages from Lockwood's journal, and there is much in them worth reading and thinking about.

The most noticeable thing in the book is the ease with which Lockwood, Brainerd, and the Eskimo Fredericks accomplished a journey to do a portion of which had cost Beaumont and his Englishmen so much suffering and disease. Why did the scurvy attack Beaumont's party, while leaving Lockwood, and in fact the whole expedition, entirely free? Surely no one will ever question Beaumont's energy and pluck. But why did he fail where Lockwood succeeded? It seems to us that this would be a profitable subject for the pens of Commander (now Captain) Markham, and his cousin (not brother, as Mr. Lanman says), the well-known secretary of the Royal geographical society, Clements R. Markham, — more profitable, indeed, than the assertions that Lockwood did not go farther north than Markham, and farther north and east than Beaumont. Lockwood thought that the weight of Beaumont's travelling equipment was enough to have used up any men. For our part, it seems probable that the cause lay deeper, and should be looked for in the difference between the winter quarters and diet of the two sets of men.

Another interesting statement is the following, from Lockwood's diary, as to the relative merits of Kane and Hayes: "Have been reading Kane and his travels. He is my *beau ideal* of an arctic traveller. . . . Hayes does not compare with him. Though beautifully written, there is an air of exaggeration about Hayes's book which destroys its interest. Dr. Pavy, who has hitherto been the advocate of Hayes, since his return from Carl Ritter Bay, seems to have changed his mind about him, and now agrees with Greely and me that Hayes never reached Cape Lieber. To have done so, he must have performed in part of his journey ninety-six miles in fourteen hours, — an impossibility." This, be it understood, is from Lockwood's diary as given by Lanman. The volume further contains a good portrait of the explorer, a poor map of his explorations, and no index.

THURSTON'S MATERIALS OF CONSTRUCTION.

THIS work, the author states in his preface, is an abridgment of the larger work by the same author, entitled 'Materials of engineering.'

It contains in a compact form for ready reference a large amount of valuable information concerning the properties of materials used in engineering constructions, and is undoubtedly one of the most complete works of the kind yet published in this country.

Students and practical engineers can hardly find any compilation better suited to supplement their theoretical text-books on the mechanics of engineering constructions than this. The work is not free, however, from some of the imperfections and faults which have characterized nearly all books of this kind, heretofore produced, by English and American authors. The title which is given to a text-book is perhaps of little consequence in itself; but under the titles 'Theory of strains,' 'Strength of materials,' 'Mechanics of materials,' etc., we have a variety of works, some of which are devoted to the exposition and demonstration of the theorems of applied mechanics relating to the action of external forces upon the parts of structures, and the resistances which oppose such forces, with a minimum amount of space devoted to the properties of the materials used; and in others the properties of materials, more or less fully treated, with a minimum amount of demonstration of mechanics so applied, but with working formulas, either introduced without demonstration or from experiments, — empirical formulas, — largely interspersed. This mingling of engineering constants and descriptions of the properties of materials with both demonstrated and empirical formulas, is perhaps necessary in such a work as that of Professor Thurston; but it requires great discrimination and art to accomplish this satisfactorily. The handbooks of Trautwine and Haswell are exceedingly useful works of this character. Professor Thurston aims to go a step farther in his formulas and explanations; but the mixing-up of theoretical demonstrations and formulas without demonstration is a fault in a text-book for students.

Text-book of the materials of construction. By R. H. THURSTON. New York, *Wiley*, 1885. 8°.

Some subjects are treated at great length, while others receive less notice; as, for example, those connected with metallurgy on the one hand, and the non-metallic materials on the other.

The introduction of pictures of a few of our most common trees, etc., in illustrations of timber, are out of place, and affect the character and dignity of the work, as such imperfect illustrations of familiar objects, seen almost daily and hourly in nature, are apt to prejudice the reader against the author.

Notwithstanding these defects, however, the work is a very valuable contribution to engineering as a book of reference for nearly all important questions connected with the properties of materials.

EXPLORATIONS IN ALASKA BY THE BROTHERS KRAUSE.

AMONG explorations in Alaska of late years, not purely for geographical purposes, the journey of the brothers Krause, under the auspices of the Bremen geographical society, holds a prominent and worthy place. Its progress was noted and its results chronicled from time to time in our pages. Numerous papers by the travellers themselves have appeared in European journals, the last being an account of the brachiopods and lamellibranchiate mollusks collected in Bering Sea and Strait, by Dr. Arthur Krause. Kurtz, Peters, von Martens, Reinhard, Hartlaub, Müller, Meyer, Richters, Arzruni, Poppe, and Kirchenpauer have reported from time to time on the natural history, mineralogy, and ethnology of the expedition. The volume under review is a consensus of all available information, both historical and recent, relating to the very interesting group of aborigines which occupy the greater part of the Alexander archipelago, with outlying villages as far north-west as the Copper River. It does not pretend to monographic com-

Die Tlinkit-Indianer. Ergebnisse einer reise nach der nordwestküste von Amerika und der Berings-strasse, ausgeführt im auftrage der Bremer geographischen gesellschaft in den jahren 1880–81, durch die Doctoren Arthur und Aurel Krause, geschildert von Dr. AUREL KRAUSE. Jena, *Costenoble*, 1885. 16+420 p., illustr. 8°.

pleteness, which would require far more profound and exhaustive studies, and much more time. than any one has yet found opportunity to give to it; but for the observations of the Messrs. Krause and their predecessors in the same field it is nearly exhaustive, and by far the most complete and satisfactory account of these people anywhere to be found. In the interest of our own students of anthropology, it would seem that an English translation would be extremely useful.

The volume opens with a sketch of the journey made by the expedition, followed by an historical *résumé* of previous explorations. This is succeeded by an account of the characteristics of the region inhabited by the Tlinkit, a chapter on their history, nomenclature, clans, totemic and tribal relations, and the position of their chiefs. The fourth chapter treats of their villages, houses, festivals, seasonal migrations, the practice of labretifery, native art (well-illustrated), and slave-holding. Then comes an account of their domestic life and customs, shamanism, and dances. A chapter is devoted to the Haida and other adjacent tribes, and another to the history of Russian and other missions among them. Lastly, we have a review of the language from a grammatical stand-point, a vocabulary, a bibliography of the literature of the whole topic, and an index.

The work is carefully and thoroughly done, and will be extremely useful and interesting to students of American anthropology. Since the miners and the missions, the navy and the mercantile element, are introducing all the changes which come with the van of civilization. it would be well, if, with this volume for a starting-point, the rapidly vanishing features of the Tlinkit culture could be permanently and monographically recorded before, as in so many other cases, it is too late. Whatever be done in this direction, we shall owe to Dr. Krause and his brother a debt of gratitude for the record which they have secured and made available, and to the society which made their investigations possible.

GEOGRAPHICAL NOTES.

A mythical Danish island. — On Danish maps near the east coast of the island of Bornholm, in the Baltic, a little island may be found named Christiansö. This is an error, for there never has been any such island there. It seems that about twenty kilometres from Bornholm is a little group of three islets, call Christiansholm, Frederiksholm, and Gräsholm, where long since were some fortifications, now in ruins, called Christiansö. How this name has been transferred to a mythical islet on the coast of Bornholm is a mystery.

A study of the Danube. — T. de Wogan has recently made a canoe voyage on the Danube, and has made a study of its sources. It appears that the river has a total length of 2,840 kilometres, and a total fall of 678 metres. The spring in the garden of Prince Fürstenberg, which has long been considered the source of the river, and is so entitled on a monument at the spot, which has been adorned at great expense by the prince, is only one of several springs in the same region, either of which has an equal claim to be so considered. In the early part of its course, the river loses much water through subterranean passages reached by fissures in its bed. These have been described by Dr. A. Knop, whose experiments have been repeated with confirmatory results by de Wogan.

The condition of Borneo. — T. Burls has visited the ancient capital of Borneo, the town of Bruni. It is situated on a river with muddy banks, about twelve miles from the sea. The houses are poor and small: they are built on piles, and thatched with palm-leaves. The sultan, alleged to be more than a hundred years old, has recently married a girl of fifteen, who is his one hundred and sixtieth wife. His territory has been the seat of several recent insurrections, which he has been powerless to suppress; and it is only a question of whether the authorities of Sarawak or those of the North Borneo company shall take possession of the rebellious districts. More than twenty British subjects of Sarawak were recently killed by the rebels on the Trusan River not far from Bruni.

South American investigations. — André Bresson has recently published a statistical and geographical work on Bolivia. Manuel Uribe Angel has just issued a work on the general geography and history of the state of Antioquia, with maps and twelve plates of antiquities, carvings, pottery, and inscriptions of a date anterior to the Spanish conquest. It contains very curious and important ethnological and linguistic material, beside valuable geographical documents relating to the little-known mountainous region traversed by the Rio Cauca, and bounded by Bolivia and Tolima from the Magdalena to the Atrato.

Travels in Laos.—The explorations of Dr. Neis in Laos during 1883–84 are recently published in more detail than the original accounts gave. Apart from their additions to cartography, they contain interesting notes. On reaching the Nam-u River, which he was the first to explore, some singular caves were observed. One is in a peaked hill, and is reached by steps cut in the rock. The second, near by but at a greater height, is difficult of access, but well repays a visit. The door with which its entrance is furnished is hung between

two enormous stalactites. It opens into a passage about twenty-five feet long, after which the cave enlarges to a great hall seventy feet in diameter, and with a tolerably level floor. The roof could not be distinguished by the light of the explorers' six candles. Everywhere the stalagmitic deposits assumed the most curious forms, such as draperies and figures. Every corner was filled with figures of Buddha, some in wood, many in bronze, some very large ones built of brick covered with carefully gilded cement. An attack of fever, due to the chill of the cave atmosphere, was ascribed by the guides to the anger of a cave deity. A sacrifice to him, and a large dose of quinine, restored the doctor's health for the time. Below the village of Pak-u are some rapids called Keng Luang, where for some distance the river is encumbered with numerous blocks of stone. On approaching these, the traveller could hardly believe his eyes, as the rocks seemed to present carved figures. On a nearer approach, they were seen to represent buffaloes, elephants, tigers, crocodiles, and even human figures or groups of immodest character. The natural form of the rock had always been utilized, and at fifty paces or so the figures were perfectly recognizable (much less so on a closer inspection), except the eyes, which appeared to have been recently recut, probably at the annual feast of waters, recently over. Neither the boatmen nor the inhabitants of the village near by, where the party camped, would give any explanation of these carvings, or even talk about them. In this village around the pagodas, a sort of carpet-gardening had been practised, plants forming the outline of various figures; and the trees of the river-bank had been cut into the form of statues. One group very ingeniously trimmed represented an elephant: a vine had been carefully trained to form the trunk. On some rocks near by were pictures of five personages, of which two had had the hair and beard recently touched up. No explanation could be had of the use or purport of these things. Above the village of Kok-han was a hill eight or nine hundred feet high, called the elephant mountain, very well recalling a couchant elephant. The eye, due to a bare spot on the hillside, appeared to be carefully kept in order by the local priests. The mountaineers of this region do a good business in rice, cotton, tobacco, lac, gold-dust, and the astringent bark which the Laotians mix with their betel. These people, in talking with each other, do not say, 'From what district (or town) do you come?' but 'What water do you drink?' all tribes, towns, etc., being denominated according to the stream or brook by which they are situated. The villages of these mountaineers are generally on some small hillock which is surrounded by a palisade, the several houses being elevated on piles for greater security. These people are called Khas. When a stranger comes, he is always offered a sort of beer made of rice. The first to drink is to be the first of the company to die. In cases where great deference is intended, the whole household drink before offering to the guest. They appear to belong to one, probably aboriginal, race with the Mois and other tribes of the Indo-Chinese mountains. They are intelligent, brave, and active, and do not fear the Hos, or Chinese pirates, who descend upon and devastate the Laotian villages, and are the terror of these people. At a large town, Muong-son, Dr. Neis found the river literally covered with rafts, upon which regular houses were built. Even the governing mandarin lived on a raft. On the alarm being given, all were ready to cut their hawsers and float down stream to avoid the dreaded Hos. The Laotians, being much less numerous than the Khas, have given up growing rice in the exposed districts, and purchase it from Khas, giving tin and earthenware, cotton and woollen cloth, and tools in exchange. To grow a crop they said would be a certain means of inviting a raid of Hos. Owing to the troubled state of the country, the explorer was obliged, after doing much important work, to retire, and fortunately reached Bangkok in safety, with all his notes, maps, and collections.

Explorations in Perak. — Interesting notes on the tin-mining of the peninsula of Malacca have been made public by Errington de la Croix, who has spent several years there in his quality of mining engineer. The tin is derived from the *débris* of granitoid rocks, which form the backbone of the peninsula. The mineral grains are very pure, separated by sluicing from the gravel, of which they form about six per cent: the washed product contains sixty-five to seventy per cent of pure tin. The work is entirely performed by coolies. The native inhabitants of the country, Sakayas and Malays, do no work; indeed, hardly exert themselves sufficiently to plant fruit-trees and rice to afford more than a subsistence for themselves. Many are fishers, some hunting is done, and a few domestic fowl and pigs are kept. The Chinese have adopted the Malay superstitions in regard to the spirits supposed to guard the mines. The visitor must take off his shoes and close his umbrella, or the spirit of the mine will decamp and take all the ore with him. At each locality the surface soil is stripped off, and the gravel is excavated to a depth of about twenty-five feet in open cuts. At each mine is a small altar to the divinity of the place, on which the Chinese make offerings of fruit and tea, and

explode bombs in honor of the spirit. Here and there are curious vertical-sided buttes of limestone, generally too steep for ascent, — the remnants of a sedimentary deposit which seems to have once covered large areas. At the base of one of these are usually found grottos, affording interesting crystalline formations and pleistocene fossils. The country is largely covered with dense forests, patches of jungle, marshes, and a few natural clearings. The forests are nearly devoid of life: few flowers, and those nearly colorless, are found. Birds and mammals are absent, and are to be found only in the clearings, where are immense troops of wild boars, large pythons, deer, and the carnivores which prey upon them. The chief pest is the leech, of which two kinds are found. One inhabits wet places; the other, the shrubbery. The latter seem to have acute perceptions. At the least sound they are on the *qui vive*, and raise themselves on the branches, waving their bodies about, ready for attack. They are an inch to an inch and a half in length, and very slender, making their way through loosely woven fabrics or under the clothing with ease. The bite continues to bleed, and often forms angry sores which are long in healing. Travel is generally performed on elephants, if by land. Mr. Errington testifies with astonishment to the intellectual capacity of these animals, and declares that all the stories he has heard in regard to their intelligence fall below the reality. The last few years have witnessed a wonderful advance in the product of tin from this region. Under the enlightened protectorate of Great Britain, and the enactment of more favorable laws, the product has risen from two thousand tons in 1876, to over seven thousand tons of bar tin per annum in 1883. Large and well-built towns have arisen; and the future of the country is bright, and only needs the introduction of sufficient labor and suitable agricultural methods to be put on a permanently prosperous basis.

NOTES AND NEWS.

THE reports of the annual conference of librarians, which was held last summer at Lake George, extend through one hundred and seventy pages, a double number, of the *Library journal*. Amid a great deal of matter which relates simply to technical administration, and is therefore of interest to librarians only, there are several papers which will be useful to all those readers who have occasion to consult a public collection of books. Among the latter may be mentioned an account of the printing of the British museum catalogue, which is furnished by Mr. Richard Garnett of the museum. Seventy-eight volumes, representing two hundred and ninety-five manuscript volumes of the museum, are printed already, fifty-eight of which are the letters A and B: twenty are from Virgil to Z. Extra copies of certain articles have been issued for separate sale; e.g., 'Aesop,' 'Aeschylus,' 'America,' 'Aristotle,' 'Bacon,' 'Horace,' 'Byron,' 'Swedenborg.' The great articles 'Academies' and 'Periodical literature' are nearly completed. 'Bible' is commenced, and it is hoped that 'Shakspeare,' 'Homer,' 'Liturgies,' and 'Dante' will follow at an early date. The catalogue, if completed, will be the largest catalogue in the world. Another noteworthy article, of a very different character, is that of F. B. Perkins of San Francisco, on the 'Free public library, its purposes and its abuses.' R. R. Bowker and T. H. McKee discuss the U. S. government publications and their distribution, — two instructive papers; E. M. Barton of Worcester advocates the distribution of duplicates; and W. F. Poole gives some excellent hints with respect to small library buildings. There are also several annual reports on cataloguing, college libraries, reading for the young, etc. There are no public officers in the country more co-operative and obliging than the librarians. Their desire to promote in every way the use of the collections intrusted to their charge is most commendable. They are rarely paid adequately, and are often overworked; but it is upon their skill, their enthusiasm, their learning, and their courtesy, that investigators, teachers, scholars, and writers of every class depend. The rapid increase of composition in this country is due to them in no small degree, and we predict that in the next five and twenty years there will be a corresponding growth in erudition.

— Prof. C. S. Sargent has republished in pamphlet form his excellent sketch of the career and work of Dr. Asa Gray, which was printed in the New York *Sun* on the seventy-fifth anniversary of his birth. It is the fullest and best account of his work which has been published, and full of interest for every one.

— Dr. Edward Laurens Mark has been appointed Hersey professor of anatomy in Harvard college. The place has been vacant since the death of Dr. Jeffries Wyman.

— A Winnipeg despatch to the Chicago *Tribune*, dated 17th instant, says: The explorations on the line of the proposed Hudson Bay railway from the north-east end of Lake Winnipeg to Hudson Bay, along the course of the Nelson River, have been completed; and Major Jarvis, with his party, reached Selkirk Saturday evening. The party

proceeded to Norway House in the middle of October last, and started from there in canoes, but were frozen in when only twenty-five miles on their journey, and had to abandon the canoes and use sleighs, drawn by men, as the means of transport. Great delay was experienced at first, owing to the larger lakes being still open, as well as some of the rivers, which necessitated a good deal of portaging, and cutting of roads through the woods. Oxford House was reached Nov. 9, the party having followed the usual boat route thus far; and from this point the real work of the exploration commenced. The country was thoroughly examined from the north side of Oxford Lake to the mouth of Nelson River in as nearly a direct line as possible, and the party arrived at York Factory, Nov. 30. On the return journey the line chosen as the result of the previous examination was followed and marked out. Soundings and sections were made at the crossings of the various rivers, and a careful estimate made of the amount necessary to build the line. Major Jarvis touched at Oxford House again Dec. 17, and from that point, following the north shore of Oxford Lake, returned direct to Sea River Falls, on the east branch of the Nelson River, about twenty miles below Norway House. The whole of the proposed railway from Sea River to the terminus chosen at the mouth of the Nelson River, a distance of about three hundred and ten miles, has been actually traversed on foot and thoroughly explored, and the result may be briefly summed up as follows: the line is quite practicable, the rock and earth work being light, with no heavy bridging, nor any work of an exceptional character. It may, indeed, be considered an easy line to construct, the country generally being level, and with a sand or gravel formation. The only rock met with was at the southern end of the line. The timber is not of large size, but enough was found for all immediate requirements. The Nelson River terminus is very favorably situated, being large, flat, well drained, and about ten feet above high water. Major Jarvis was accompanied by R. J. Money, civil engineer, assistant to Mr. Shelford, the well-known English engineer. Mr. Money is also perfectly satisfied with the feasibility of the scheme. The total distance walked over was upwards of a thousand miles.

— The fish commission steamer Albatross will leave Washington, as soon as the ice in the river disappears, for Norfolk, Va., where she will undergo a few necessary repairs, and thence sail for the Bahama Islands, where several months will be passed in scientific research and hydrographic work. An efficient corps of naval officers and scientific experts will accompany the ship, among whom are the following: Lieut.-Commander Z. L. Tanner, commanding; Lieut. H. S. Waring; Lieut. B. O. Scott; Ensign W. S. Hogg; Ensign W. S. Benson; Surgeon J. M. Flint; Passed Assistant Engineer G. W. Baird; paymaster, C. D. Mansfield; chief naturalist, Mr. J. E. Benedict; assistant naturalists, Mr. Thomas Lee and Mr. Willard Nye.

— The gratifying success of hatching cod artificially at Wood's Holl, recently attained by the U. S. fish commission, marks a new era in fish-culture. It is now the intention of Professor Baird to attempt the acclimatization of the codfish in the Gulf of Mexico, and to this end one million of young cod will pass through Washington during the present week *en route* to Pensacola, Fla., to be placed in the Gulf of Mexico.

— Considerable interest attaches to the country around Commander Islands and Kamtchatka. Dr. Leonhard Stejneger of the Smithsonian institution visited this region in 1882–83, and also visited the territory worked over by Steller, bringing back with him many relics of that expedition, and also portions of skeletons of the extinct sea-cow, and of a vast number of birds and cetaceans. The results are interestingly told in Bulletin No. 29 of the national museum, which contains 382 pages, and eight colored lithographic plates from sketches by the author.

— Bulletin No. 30, 'Bibliography of publications relating to collection of fossil invertebrates in the national museum,' by John Belknap Marcou, will be issued in about two weeks. It contains a complete list of the writings of F. B. Meek, C. A. White, and Charles D. Walcott, and is an important contribution to this branch of science.

— The fifth annual ensilage congress met in New York, Jan. 20. There were about two hundred persons present as delegates from all parts of the United States. The opening address was delivered by Mr. Edward Atkinson of Boston, who was followed by S. C. Smith of St. Albans, Vt., Orlando B. Potter, and James B. Brown.

— The chemical division of the U.S. geological survey is conducting a series of interesting experiments with newly acquired material, under the supervision of Prof. F. W. Clarke, who is about completing an investigation of minerals from Litchfield, Me. Among the minerals there existing, a new species of the zeolite family has been found, to which Professor Clarke has given the name of hydronephelite. Messrs. Gooch and Whit-

field are engaged in an investigation of the geyser waters of the Yellowstone park; Mr. R. B. Riggs is making a series of analyses of the lepidolites of Maine, and is also analyzing an undescribed meteoric iron from the collection in the national museum; Mr. Hillebrand is engaged on minerals and rocks from Colorado; and Mr. Chatard is at work upon the associates of corundum from North Carolina, and upon the water of Mono Lake, California.

— A change has been made in the time of issuing the Smithsonian and national museum reports. Heretofore these reports covered the calendar year; but the board of regents of the Smithsonian institution have recently directed that the reports shall hereafter correspond to the fiscal year extending from July to the end of the following June inclusive. The reports from Jan. 1, 1885, to June 30, 1885, are now about ready for the printer; the report of the secretary of the Smithsonian institution to the board of regents, for the first half of 1885, being already published in pamphlet form.

— Bulletin No. 28 of the national museum, recently issued, is W. G. Binney's 'Manual of American land-shells,' which is an enlarged and revised edition of the 'Land and fresh-water shells of North America,' part i., published in 1869, to which subsequently described species are added.

— The *Botanical gazette* for January contains a heliotype engraving of Professor Gray, with a sketch of his life by Prof. C. R. Barnes. Other articles of interest in this number are by Professor Coulter, on the 'Pollen-spore of Tradescantia;' J. C. Arthur, upon a new fungus infesting the clover-leaf beetle, Phytonomus punctatus; a new species of Anemone, by Professor Gray, etc.

— The first number of the monthly *Journal of the Trenton natural history society* contains a number of short, readable articles, mostly on animal and plant habits.

— The joint commission appointed by the last congress to consider the propriety of consolidating the scientific bureaus of the government have concluded the examination of witnesses, and will shortly submit their report. While their recommendations are not definitely known, it is probable some sort of re-organization will be advised with regard to the signal service, and it may be entirely separated from the army. General Sheridan is authority for the statement that the army does not need this wing of its service, and that there is no objection to placing it under civil control.

— In *Science*, vii. p. 75, in the letter entitled 'An early prediction of the decay of the obelisk,' second line, 'St. Petersburg' should read 'Freiberg.'

— In *Science*, vii. p. 75, in the letter entitled 'Sea-level and ocean-currents,' seventh line, 'Bourdalone' should read 'Bourdaloue;' thirty-third line, 'diversity' should read 'density;' p. 76, second column, thirteenth line, '25 feel' should read '2.5 feet.'

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The festoon cloud.

In *Science*, vii. p. 57, Prof. W. M. Davis, after giving a description of a form of cloud designated 'festoon' cloud, asks if the cloud is commonly seen in this country. I have seen the form of cloud described at least as often as a dozen times within the last six years; but, on account of not having my records at hand, I cannot give the dates.

I have seen the cloud once or twice associated with thunder-storms, but most frequently with the stratus-cloud accompanying 'areas of low pressure,' or cyclones.

The appearance presented to me is that of a cloud-stratum with an irregular base, in contrast with the level base usually seen.

The cloud then presents an appearance as if festoons were hung from it, which are sometimes somewhat circular and rounded, at other times irregular.

The explanation given that they are due to the slow descent of cloud-matter, due to the failure of an ascending current, is, no doubt, the correct one.

H. Helm Clayton.

Cambridge, Mass., Jan. 24.

Text-books on methods in microscopic anatomy.

The review of Dr. Whitman's 'Methods in microscopical anatomy,' in *Science* (No. 154, p. 64), seems to me not quite just, in that it implies that the author has been negligent in the performance of his task, particularly in regard to that part of it which most gives value to his work; namely, the chapter on embryological methods. In this the author has given a careful summary, the outcome of much laborious and painstaking search; so that we have for the first time a compact presentation of a large number of special methods for the handling of embryological material. It is true that it is not exhaustive, — I am grateful that it is not, — but it contains most of the best results of experience in the difficult art of preparing eggs and embryos of many kinds for microscopical examination. And since it is just in this direction of microscopical embryology that the most earnest and capable zoölogical energies are now turned, I feel that Dr. Whitman has done science good service by the valuable critical compilation made in the chapter referred to. Now, I wish to find fault with your reviewer because he says that "the arrangement [of this chapter] leaves the impression that it is the result of fortuitous reading rather than a methodical search for the most valuable things

the scope of the topic." The sentence
s me, and leads me to inquire what was the
he opinion; for it does not appear to be in
pter itself, the arrangement of which is
t and intelligible, and certainly not based
fortuitous reading. The author of the
he has read the review, must, one would
el mortified to have such a bald accusation
ence brought against him: I trust, there-
t you will publish this letter, to show that at
worker in this field places a higher value
volume than your reviewer does, with his
f commendation.

CHARLES SEDGWICK MINOT.

ass., Jan. 20.

nder great obligation to Dr. Minot for the
he has done me in calling attention to the
of my recent review of Dr. Whitman's book.
self astonished at it, and cannot comprehend
uld have made so unfair a statement when
d no injustice.
"This chapter furnishes much valuable in-
n, but the arrangement leaves the impression
the result of fortuitous reading rather than
dical search for the most valuable things
e scope of the topic"
ntence as it stands leaves me indorsing what,
ed to me, might be the inference of one who
oked at the arrangement of the chapter as
of the separate consideration of so many
animals — e.g., Clepsine, Spirorbis borealis,
na. Sagitta, etc. — instead of classes of ani-
What I should have added was, that such an
on would be entirely misleading. I had not
idea of making that impression represent my
but quite the reverse, for it was in direct
n to my positive knowledge; no one, perhaps,
better than I that the author's work had
the most painstaking and discriminating
n my estimation, moreover, there was no
in this country who possessed in so great a
he experience and the other qualifications
y to the successful handling of this topic.
ards the general tone of the criticism, I can
that the esteem in which I hold the author
distrustful of my ability to praise his work
sly, and that in avoiding one extreme I have
to the error of the opposite, and appear only
ise where there is much more that I ought to
ised.

EDWARD L. MARK.

idge, Jan. 25.

Cost of scientific books.

dly proportion of the book-notices in your
l contain a statement to the effect that the
r has been too profuse in his paper; that he
use a poorer and thinner quality, and sell
at half the price. This betrays a lamen-
norance on the part of your critics, and,
conveys a very erroneous impression. Paper
inconsiderable item in the cost of manufac-
book. It is a good-sized volume which,
the covers, will weigh four pounds, and
good as that in most of the books criticised
y ten cents a pound. The utmost that could
l by lightening and cheapening would be a
weight, and two cents a pound in price,
ucing the cost of the paper of a four-pound
m forty to twenty-four cents, certainly not enough reduction to allow the price of the book to be reduced from four to two dollars.

The cost of the plates is the greatest item in the production of a book, and the ruling price for this work is eighty cents per thousand 'ems' (a page of Packard's 'Zoölogy' contains about a thousand 'ems'). Then all the cost of corrections, other than mere typographical errors, and the cost of making up the pages and inserting the cuts, are all charged as time-work. The cost of corrections in scientific work is enormous, and I have known it to amount to one and a half times the original cost of composition. A fair average for the plates for a book with the same page and type as that of Packard's 'Zoölogy' would be a dollar and a half a page. This must be considered in settling the price of a book.

Finally, the sale of strictly technical books is very limited. An edition of five hundred is a good average; and, were the price reduced to half the ruling price, the sales would not be increased ten per cent. As it is, they little more than repay the cost of publication, and the reduction so earnestly and ignorantly prayed for by your critics would involve the publisher in a considerable pecuniary loss on every strictly scientific book issued; and a few failures of that sort would make them refuse all scientific books.

I do not wish to be understood as defending the prices put on all publications; for some the charge is clearly extortionate: but, so far as I at present recall, not one of those thus criticised in your columns has a price higher than was necessary to reimburse the publisher for his outlay, and pay him a fair amount for his labor in publishing, advertising, and selling the work. I hope in future your critics will omit any reference to this feature in their fault-finding.

J. S. KINGSLEY.

Malden, Mass., Jan. 19.

Oil on troubled waters.

I feel that I must offer a few words of rejoinder to your comments on my letter of Jan. 18, because I cannot admit that there is any grave responsibility involved in my inquiring for the proofs of an alleged scientific theory, or any lack of feeling implied in my protesting against a disposition to hold out a misleading hope to 'the toilers of the sea.'

I have not tried to throw discredit on any well-directed effort to render less dangerous the hazardous vocation of the sailor: I have simply attempted to raise a note of caution against false inductions and specious generalizations. I look upon this as a question of science, not of sentiment; and I have been accustomed to regard science as a matter of hard, clear facts, and keen, cold logic.

It may possibly be that the hydrographic office is affording substantial comfort to the mariner's generally cheerless life by disseminating the fables and traditions of the sea; but, if so, it is a purely literary undertaking, not a scientific one. It may while away an otherwise tedious hour or two on shipboard to read, in effect, that a half-barrel of oil sprinkled over the entire course between New York and Liverpool will insure a safe voyage at any time and in any weather; or that a half-gallon, poured upon oakum, tied tight in a bag, and towed at the stern of a vessel, will reduce the mountainous billows, ease the strained sails and cordage, brace the bending spars and timbers, and bring welcome, peace, and quiet where all before was wild confusion and danger.

But, to a cool-headed landsman, this will appear so astoundingly incredible, that nothing short of the most searching scientific investigation and rigid experiment can give it even a tinge of probability. Either this apparently transcendent miracle is capable of a rational explanation and demonstration, or it is a myth and a delusion. To my mind, the use of the oil-bag upon the ocean is strongly suggestive of the idea of applying a liver-pad to a cyclone.

It is of no avail to quote Pliny or other mere chroniclers, ancient or modern, or to pile up the inexact and awe-inspired tales of seafaring men. I admit that the history of the notion is interesting, like the history of the acceptance of any other prodigy; but there is a wide difference between the progress and persistence of a belief and its scientific truthfulness.

Now, I do not pretend to have seen all the evidence which the hydrographic office has collected or published on this subject, and I shall not undertake to say that relatively large masses of oil, spread upon comparatively small bodies of water, may not, under some circumstances, modify or prevent the formation of waves. But that oil filtered into the raging and turbulent deep at the rate of a quart per hour, — or even a gallon per hour, as reported in the letter printed by you last week, — should prove to be an adequate cause for the marvellous effects attributed to it, is, to me at least, a thing utterly and absolutely inconceivable; and I confess to a disturbance of my faith in any institution that gives such stories credence or currency. C. F. COX.

New York, Jan. 24.

The collapse of the theosophists.

Permit me to take exception to the article entitled 'The collapse of the theosophists' in your issue of yesterday.

I have no contention with any statement, correct or otherwise, which the article contains, and offer no argument *pro* or *con*; but I beg to be allowed to use this occasion to protest against and to obviate the prevalent misconception that 'Blavatsky' and 'theosophy' are synonymous terms, or that either the manners or morals of any individual theosophist necessarily represent the methods, objects, and purposes of the theosophical society.

In my judgment, the 'collapse of the theosophists' is a prediction much safer to make after than before the event: there being, to my knowledge, no organized body of psychical researchers in the world less likely to verify any such prophecy.

ELLIOTT COUES, F.T.S.,
President Gnostic branch, T.S.,
President Amer. B. of C., T.S.,
Member Exec. C. of India.

Washington, D.C., Jan. 23.

Nectar-secreting plant-lice.

Oregon is the place for nectar-secreting plant-lice. During the past fall I received twigs of spruce and willow from that state, which, though not more than six inches long, contained at least a tablespoonful of crystallized sugar, which was both pleasant and sweet. This insect is a species of Aphis, and though possibly not equal to the bee, or to the manufacturer of our best cane-sugar, in her power to form an excellent article of sugar does surpass greatly the glucose factories in the quality of the product which she turns out. A. J. COOK.

Sea-level and ocean-currents.

The value of the conclusions arrived at by Professor Ferrel in his article in *Science*, No. 155, headed 'Sea-level and ocean-currents,' depends largely upon a statement made by him; viz., "The recent important determination of the coast and geodetic survey by levelling up the Mississippi valley and across to the Atlantic coast, that the mean level of the Gulf of Mexico at the mouth of the Mississippi is about one metre higher than that of New York harbor."

An item so important in ocean dynamics for comparison of facts with theories should be known to be most unquestionably correct. I am not aware of any official publication of the coast and geodetic survey to which the above statement could be credited, and, what is more, such a line of spirit-levels has never, to this day, been executed by the survey. Probably a paper read before the American association at the Philadelphia meeting in September, 1884, gave rise to the supposed fact. On p. 446 (vol. ii.) of its Proceedings, we find, "Height of bench-mark at St. Louis above mean tide at Sandy Hook 3 feet" (*sic*), and, "Precise line of levels from Gulf, by Mississippi River commission, along the river, shows an elevation of the Gulf of Mexico, near the mouth of the Mississippi above mean tide at Sandy Hook, of about 40 inches." Here the responsibility is placed on the commission.

By permission of the superintendent of the survey, I make the following extract from a report by me, dated May 24, 1883: —

	Metres.
1. Height of coast and geodetic survey bench-mark at the St. Louis bridge above the average or half-tide level of the Atlantic at Sandy Hook, N.J., as ascertained from six years of tidal observations.	126.91
2. This bench-mark was placed at the same level as the so-called St. Louis city 'directrix.'	
3. From precise levels executed by the Mississippi River commission and the U. S. lake survey, St. Louis city directrix above the Greenville, Miss., bench-mark (on bank building), according to letter from commission dated May 18, 1883......	86.185
4. By coast and geodetic survey levels, Greenville bench-mark above the Hampson bench-mark at Carrollton, La.	37.267
5. From Humphreys and Abbot's work on the Mississippi River (1861), p. 110, it appears that the Hampson mark is 8.06 feet or..................... above the level of Lake Pontchartrain, which is said to be at the same level as Lake Borgne and Bayou St. Philip, and hence with that of the Gulf.	2.456

Putting these figures together, it would appear that the Gulf level is about one metre above the level of the Atlantic at New York. The report further comments on this result: "While there is nothing impossible in this result, the difference is greater than I [the present writer] expected from the conditions of the case, but it may possibly be greatly reduced when precise data come to hand; and, in particular, more evidence is desirable as to the connection of the Hampson mark with the average Gulf level. We have no checks at present."

It is evident that no probable error can be assigned to the alleged difference, and that the amount itself is greatly in need of confirmation, which it is hoped will soon be reached through the direct line of levels started by the coast and geodetic survey to run from its Illinois line to the shore of the Mississippi Sound.

C. A. S.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 29, 1886.

PROFESSOR LADD ON THE YALE CURRICULUM.

WE presented in *Science* (vi. p. 499) a synopsis of Professor Palmer's article on recent changes at Harvard. We now give an abstract of an article from the same journal, the *Andover review*, on the question of electives, etc., at New Haven, by Professor Ladd of Yale.

The new education, as brought to our notice afresh by Professor Palmer, claims to have discovered that the methods of education in vogue for centuries have been radically wrong: it has organized a college on a wholly new basis.

But the proposed scheme, though revolutionary, and seeming to contradict experience, does not the less merit consideration. Before placing our faith in it, however, we ask, What experience can it boast? What trial has it had at Harvard? We answer, A trial for two years; for only during that short period have youths in the first half of their university course been placed completely under the elective system; and it is to this extension of the system that opposition is chiefly made. More than a generation is necessary to prove the final outcome of such great changes. Is, then, the experience of a single university, during but a moiety of its course, to be considered as sufficient?

But we shall be glad to examine the arguments so well presented and so courteously urged by Professor Palmer, and to compare the tabulated results of the new with those of the older method. Harvard has been chosen as the only thorough representative of the new education; and it is fitting that Yale should be selected to compare with it, partly because, as a teacher there, I am best acquainted with it; and partly because it is the leading representative of more conservative tendencies in education.

But let me first state some points in which I agree with Professor Palmer. I, too, hold that the world of science and learning has greatly progressed of late, and that both the matter and method of education must therefore also change. Sciences and modern lauguages must be taught, and the ancient classics take a relatively lower place than formerly. But all the best institutions recognize and act on these facts and truths. Within twenty-five years, Yale has made such progress that much of its education may be styled 'new.' Then, again, along with Professor Palmer, I would measure the success of education by high ethical standards. But do the statistics given show that the new education uplifts character as no other training can? We think we can show that they go rather to prove the contrary. We shall, then, take up, in the order that commends itself to us, the various points adduced by Professor Palmer.

It is urged, that, under the new education, the student's ideal of a 'gentleman' has been enlarged and elevated. Hazing, and such practices, are no longer 'good form' at Harvard. We answer, that it is even so at Yale, where a marked improvement in these regards has been going on for the past twenty-five years. Of other institutions also, to a certain extent, the same is true. The causes of this improvement are not owing to any peculiar method of education, but to the gradual amelioration of customs due to a higher civilization; to the different attitude assumed by parents and teachers towards the young; to wiser dealings with students on the part of college faculties; and, lastly, to the influence of well-regulated athletic sports in giving an outlet for the surplus vitality of the youth.

But it is claimed that the new education is very popular. The growth of Harvard under it has been very great, both in numbers and resources. But, we ask, has it received these generous gifts as tokens of approval of the elective system? Have not other colleges also received very bountiful gifts? During the last fourteen years, Yale has received, either from gifts or by bequest, more than two and a half millions, while its library has increased by eighty-three thousand volumes. Though this sum does not equal that received by Harvard during the same time, yet it tends to throw doubt on the prestige of the new education with the long purses of the country.

The increase of students certainly does show popular favor. We admit that the new education would be likely to be popular with youths of eighteen. But Yale, too, shows remarkable growth during the past twenty-five years. The average number of undergraduates has been as follows: 1861–65, 533; 1866–70, 610; 1871–75, 704; 1876–80, 745; 1880–84, 792. Besides, no other college has rejected so large a per cent of candidates for admission, or sent away so many for failing to keep up to its standard of scholarship.

We find, too, from the last statistics, that more than 55 per cent of the students at Harvard were from the state in which it is situated, while less than 32 per cent of the Yale undergraduates are from Connecticut. The new education is, at all events, not yet cosmopolitan.

Let us next compare Harvard and Yale in the very important point of attendance at college recitations, etc. Professor Palmer thinks it creditable to the members of the last senior class at Harvard that they 'had cared to stay away' at only 16 per cent of all the recitations. At Yale this term, for the seven weeks for which the record is complete, the freshman class showed but 3.7 per cent of absences. In this record are counted absences from all causes whatsoever: it includes the absence of one student through sickness for forty-eight days. The absences in the sophomore class were but a little more than 3.3 per cent. Moreover, all tardiness at a recitation beyond five minutes, and all egresses, count as absences; as does also presence at a recitation, while wishing to be excused from answering. Freshmen and sophomores are allowed but six absences during a term, to cover all such causes as sports, attention to friends, etc.; and yet they did not avail themselves of more than three-fourths of these absences. The junior and senior classes, which are allowed eight absences in a term, showed, during the period of seven weeks, an irregularity of 5.5 and 6 per cent respectively. We may add that the showing for the whole term would probably be better than for the first seven weeks of it.

We see, then, that the irregularity of the Harvard student is from a little less than three to five times as great as that of the average Yale student. The difference is surely very significant as showing the working of the two systems.

Alluding to the "charge of 'soft' courses," "which," he says, "is one of the stock objections to the elective system," Professor Palmer shows us what wise courses the juniors and seniors of Harvard choose. I regret that we are not told how the freshmen exercise their right of option. So far as I can judge, the choices of the Yale juniors and seniors display more taste for hard work than is the result under the new system. No course in classics or in the higher mathematics was a favorite with the two upper classes at Harvard in 1883–84, while 54 juniors and 181 seniors are reported in 'fine arts,' for this year. At Yale this term, however, 53 choices of courses in higher mathematics, and 179 in classics, have been made. The student who has been at regular hard work during his first two years, will be likely to enjoy it in his last two.

Another excellency ascribed by Professor Palmer to the new education is, that under its influence the standard of 'decent scholarship' is steadily rising. To prove this, he cites the marks received by the average Harvard student during the different years since 1874–75. We frankly state that we think such a criterion most unreliable. The students' marks are higher under the elective system, but largely because the teacher, as well as the pupil, is known by his marks; and many students choose their elective because of this fact. Under that system it would be a better test of a pupil's real merits to inquire what courses he takes under teachers that give hard work and low marks.

The new education is also credited with having effected an improvement in the spirit and work of the instructors themselves. We accept Professor Palmer's testimony as conclusive on this point. But in other colleges besides Harvard are to be found the spirit and method which he justly praises; and without them no one should be an instructor under any system. May not, also, a method that makes so much depend on the favor of those taught, develop methods of instruction not conducive to the highest efficiency?

I may remark here that I cannot share the personal experience of Professor Palmer, when he, on looking back upon his college days, feels that more than half of his studies should have been different. My studies at college were wholly prescribed, but they have been none the less of use to me on that account. They have taught me to work hard, and to do patiently every task set before me; and this I would not give for all to be gained from the elective courses of either Harvard or Yale.

But the real matter of disagreement between Professor Palmer and myself is, "why the elective system should be begun as early as the freshman year." This, he says, lack of room precludes him from discussing; adding, "and it hardly needs proving." But here, in my opinion, he is wrong. Yale, with many other colleges, allows much choice to students in their last two years; juniors elect eight-fifteenths, and seniors four-fifths, of their studies. No choice, except that between French and German, is permitted in the first two years. Why, then, am I opposed to the extension given to the elective system at Harvard? Why draw the line between sophomores and juniors, rather than at the entrance upon the freshman year? Why prescribe any courses for the last two years?

The question is simply one of drawing lines. We think, that, after two years' drill at college, the youth can more wisely select his studies than at entrance. Professor Palmer thinks that the

choice should be made all at once, and that at the time when the boy leaves home; that from that time onward he should have the entire decision. We hold, on the contrary, that he should first develop somewhat in his new surroundings, learn better how to study, and what the different courses are, before he has the grave task of deciding. Moreover, a headlong plunge into freedom is not a good thing. I still think, also, that an educated man should enjoy a good training in the five great branches of human knowledge, — in mathematics; in language, including literature; in physical science; in the history of his race; in philosophy. Because, then, I do not think that the new education draws the line in the right place, I am opposed to its extreme measures.

One argument of Professor Palmer hardly admits of statistics. He thinks the type of manliness at Harvard higher than that to be found at colleges that have not so fully adopted the elective system. I reply, that I do not believe the men at Yale yield in manliness to those of any college.

My ideal of cultured manliness in the undergraduate agrees with that of Professor Palmer: as to how best to realize it, we differ. In my opinion, he gives too little weight to the great ethical law of habit, and to the value of the pressure of immediate necessity. We want to train the young to choose right spontaneously, but none of us live solely under the influence of high and remote ideals. Under a system of education, which kindly but firmly invites men to 'choose right,' in view of consequences that come closely home to them, the best characters will be formed.

Having now pretty fully traversed the ground of Professor Palmer's arguments from experience, I wish, in closing, to express, on behalf of the majority of educationists, the fears — honest and strong fears — which they feel as to the ultimate results of the new education.

We fear that the new education will increase the tendency to shallowness, already great enough in American student life. We have already too much smattering of many knowledges. The chief remedy must be to pursue certain topics with persistence and thoroughness. If the average American boy, on entering college, had had the discipline afforded by the drill of a German gymnasium, he might more safely judge for himself. Two years more of continued study of certain prescribed subjects — whatever these may be — is certainly little enough to require of him.

We are afraid of the effects of the new education on the academies of the country. They have been gradually improving under the increased requirements of the colleges; but how shall they meet the demands made by boys, who, under the new education, may enter college in so many different ways? What interest, also, will boys take in mathematics and the ancient classics, when these are liable to be abandoned so soon as they have attained free election?

We are afraid of the effects of the new education on the higher education of the country, which has been constantly rising for years. The new methods, in themselves considered, are better than the old: and the new learning and science are, of course, far richer than those of the past. But, in order to introduce these, is it necessary to take the direct control from the older and wiser, and leave it to the choice of the inexperienced? Such a course will, in certain lines, destroy all connected and steady discipline in higher education.

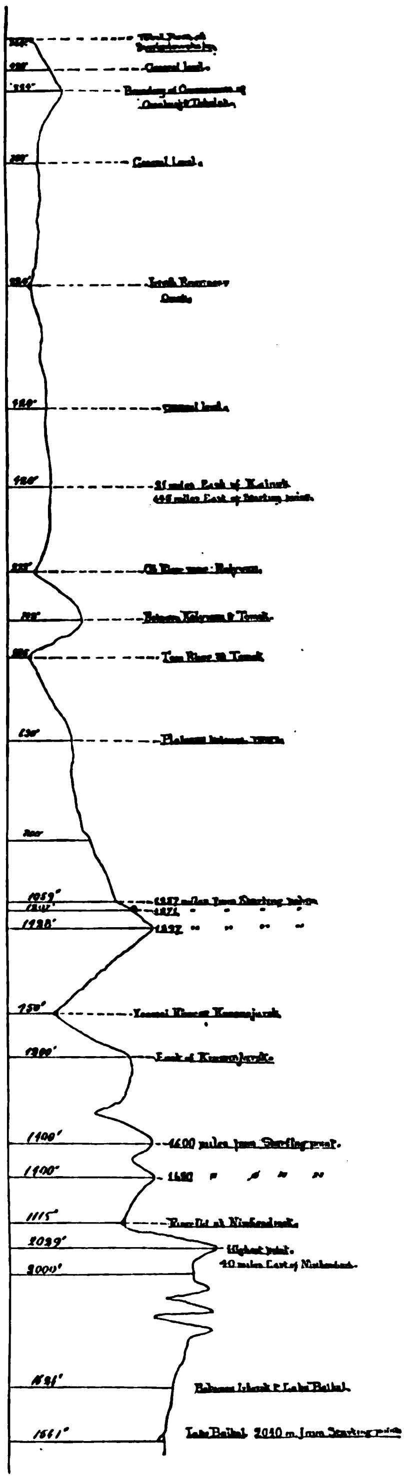
Finally, in spite of Professor Palmer's arguments, we are afraid of the effects of the new education on the character of the youth.

We think we have shown, that in every respect, except that of securing $175,000 instead of $250,000 a year, and of making a smaller percentage of annual gain in numbers, the results of the system in vogue at Yale are equal or superior to those at Harvard. We need much more light, both from reason and observation, before preferring the new education to one which is, in our judgment, wiser, though both new and old.

THE LEVELLING OF SIBERIA.

THE publication of the results of the Siberian levelling, the largest of the kind yet made, is at last ended. The survey originated in the Imperial Russian geographical society, which petitioned the Russian government to grant the necessary means, setting forth the want of an accurate knowledge of the height above sea-level of a great part of Siberia. The preliminary results were known in 1878, and gave a much greater height for Lake Baĭkal than was expected. The detailed calculations were delayed from different reasons, among which were the long illness and death of Mr. Moschkow, to whom was intrusted the greater part of the work. It was afterwards given to W. Fuss, who ended it. The whole length of the levelling from Zwerigolowskaja on the Tobol to Lake Baĭkal is 3087.1 versts (2,040 English statute miles). Unfortunately the starting-point is not connected by levelling with the Black or Baltic seas, but by triangulation only, so that an uncertainty of perhaps thirty or even forty feet remains. The results are shown in the accompanying profile.

Gen. A. Tillo has the direction of different levellings under the ministry of public works. In 1884 the mean level of Lake Ladoga over the Gulf of Finland was determined, and found to be 16.3



RESULTS OF SIBERIAN LEVELLING.
From Zwerigolowskaja on the Tobol to Lake Baikal.
Horizontal distances on a scale of 2,040 miles to 27¼ inches.
Vertical measurement on a scale of 500 feet to 1 inch.

English feet, while the formerly admitted height was 66 feet. Such a great difference from the formerly admitted height is startling, yet the new figures are the result of so accurate and well-checked operations and calculations that their result cannot be doubted. According to the new determination, the slope of the Neva is about the same as that of the Volga in its middle course, while the formerly admitted heights made it four times greater. To have another check on the height of Lake Ladoga, the barometric means of H. Schlusselburg were compared with those of St. Petersburg for a mean of eight years. The difference of level of the Ladoga and Gulf of Finland, determined barometrically, is but 8.6 feet; that is, less by 7.7 feet than that determined by levelling. If we suppose both series of observations to be equally accurate, and the instrumental error determined with the greatest precision, this would prove that the mean pressure rises toward the east, — a result quite consistent with the general course of the isobars in Russia; but the difference is rather too large for so small a distance.

Lakes Husen and Onega have also been levelled, and the figures for them will shortly be published. Their height was also found to be smaller than formerly admitted.

A. WOEIKOF.

POPULAR PSYCHOLOGY.

SOCRATES, Cicero tells us, called down philosophy from heaven to earth, and introduced it into the cities and houses of men. In each stage of the development of a science an essential step is the diffusion of the general tendencies and results obtained amongst the intelligent public. Nowadays, when each branch of study must make good its claim to a place on the curriculum, it is more than ever necessary to acquaint the cultured and powerful public with the general problems and broad outlines of your science. Thus it has come about that a certain class of scientific men have almost made themselves specialists on the topic of popular science. It is largely to them that the public looks for their scientific enlightenment. A larger and more important class of popular scientists, very fortunately, are the masters of science themselves. When such men as Huxley and Helmholtz prepare with their own hands the scientific food for the public mind, there really must be an inadequate power of reception of such knowledge, if a healthful, wide-spread activity in science is not the result.

Psychology, since it has received the impulse which has made 'physiological psychology' a common description of it, has made sufficient

progress to be able now to give in a popular dress an account of its aims, its problems, its methods, and its results. It is fortunate that Professor Wundt, whose name perhaps, more than that of any other person, has become associated with this modern movement, has given his time to a more or less popular exposition [1] of a few departments of this diffuse subject. The development of experimental psychology has been such a rapid one, that already one must be a specialist in one department of it. To some extent Professor Wundt has confined his essays to an account of work done in his own laboratory, while another portion of the book presents views upon those general problems, interesting to every generation of mankind, which seem to him most adequate and scientific.

In an essay on the problems of experimental psychology, he contrasts the method of this science with that of metaphysics, with which it is historically closely connected, and defends it from the attacks and prejudices of its opponents. On the one hand, the metaphysicians raise the cry that it is only 'crude empiricism,' a mere attention to natural phenomena, a lower field of work, perhaps good enough for those who are willing to enroll themselves in such a cause; while the nobler, higher flights of pure philosophy, where every problem finds its solution worked out with a wonderful ease and regularity, are widely open to him. On the other hand, the exact scientists regard this new aspirant for a place amongst the sciences with a suspicious distrust of the justness of its claim. The best answer to the first is to prove to him that many of the problems discussed, *pro* and *con*, by various metaphysical schools, can be brought into the laboratory and solved there with the aid of suitably devised apparatus. The answer to the latter will be a demonstration that within natural limits the same regularity and predictability that characterizes his own work, also holds in experimental psychology. In other words, it is the 'measurement of psychic processes' (the subject of the next essay) that forms one of the main problems.

The beginning of all culture is a clock. Where the conditions of life are so primitive that a time standard is unnecessary, there can be little mental development. For measuring time, man need not invent an apparatus, but has only to learn to tell time on the world-clock, the movements of the heavenly bodies. But it is to be noted that time, though objectively measured, is really a psychic process; for our perception of time is not changed when the clock stops, but is changed when we fall asleep. One by one the measurements of physical phenomena are required, and last comes the utilization of these physical measurements for measuring the psychic processes. The first time sense is the flow of sense impressions; the last step is to turn back and measure these impressions. Some sort of philosophy or psychology appears early in history; then come the great advances of physics; in the last stage, a psycho-physics.

[1] *Essays.* By W. WUNDT. Leipzig, *Engelmann*, 1885.

Perhaps it is only a coincidence that it really was a branch of physical science, astronomy, that performed the first experiment which led to the long series of studies of psychic time. Even a martyr can be pointed out in this cause; for it is told that an observer at Greenwich, whose observations were unusually slow, was often boxed on the ears for this peculiarity, and afterwards discharged. Twenty years later Bessel saved the honor of our martyr by pointing out that each person had a 'personal equation' of his own; that it took an appreciable time to record an observation after it was made, which time differed in different individuals. If we were asked to press a key as soon as we saw an expected flash of light, it would seem to us that the reaction was instantaneous. But still ordinarily it takes from an eighth to a sixth of a second. About a half to a tenth of a second is taken up in central brain processes, while the rest is used in conducting the impression to and from the brain. If, instead of reacting when we saw the light, it was agreed that the reaction should take place only after the color of the light had been perceived, the additional time necessary for perceiving this color might be called the 'distinction' time, and would vary from a twentieth to a fiftieth of a second. In this way the time necessary for hearing syllables, words, seeing colors, figures, pictures, letters, and so on, and understanding them, is open to measurement, and the relative time required for these operations marks their complexity. Again: we can agree, that, if you see a blue light, you are to react with the right hand; if a red, with the left. Here is, first, the time for perceiving a light already measured, then the time to distinguish its blueness or redness, also measured, and then the 'choice' time necessary for selecting the appropriate hand for the color seen. This last psychic process takes about as long as the 'distinction' time. Of course, it depends on the number of reactions from which the choice is to be made. If it is one of two, the time would be a tenth of a second; if one of ten (say, the ten fingers), the time would be half a second. A rather curious result of these observations is, that it takes almost as long to perceive a single letter as it does to perceive a one- or two-syllable word, which shows that the word is perceived as a whole, not as a combination of letters, — that it is

the psychic unit. The next step takes us still further into the nature of mind by measuring the time necessary for one idea to call up another related to it in any way, — 'association time.' This process is evidently a more complicated one, a higher function, and takes a longer time, about half to three-fourths of a second. Individual differences are very great here, and we are at the beginning of those mental qualities which in their extremes distinguish the genius from the dullard. Not only the time, but the kind of association, is characteristic of the individual. The direction of one's associations is as good a clew to his character as can readily be gotten. If we limit the subject to one kind of association, for instance, what the logicians call 'subsumation' (that is, for example, if the word is 'horse,' the associated word must include horse as 'quadruped,' 'animal'), the time is longer by about a tenth of a second than unrestricted association time.

Another very curious result which was wrought out in Professor Wundt's laboratory is the peculiar effect of attention, which actually makes you hear or see a thing before the thing is there to be heard or seen. If you are to observe opposite what stroke of a graduated circle an indicator attached to a pendulum is swinging when a bell strikes, then, after the interval between the beginning of the swing and the ringing of the bell has become fixed in your mind, you will anticipate the stroke of the bell, and make it ring a fraction of a second before it really sounds. But a further discussion of this question would carry us too far. It has been shown, that, compared with such motions as light, sound, or electricity, nerve-conduction is slow, and those nerve processes associated with the more complex sensations and perceptions very slow indeed; that by measuring these times we will obtain a graded scale of the complexity of some of the simpler mental processes, and gain a deeper insight into their nature.

This essay has been selected because it represents, perhaps, the more strictly original part of the book better than any other. Most of the others are inspired by new points of view, as, for example, the one on language, which takes its basis from the observations on the development of language in children and deaf-mutes.

From the English side comes an attempt to give in a popular form the results of studying the insane and deranged as far as such study bears on certain peculiar historical and psychological facts.[1] One general topic in which the author is deeply interested is the hallucinations of eminent historical characters. The list of these is so strikingly large, if one is willing to take into account very small deviations in mental soundness, that it has led to the thesis (old as Aristotle) that genius and insanity are closely allied. But the cases treated by Dr. Ireland are only those in which this hallucination gave character and motive to the life of the individual. The peculiar mental condition of Mohammed, Swedenborg, and Joan of Arc, are graphically and instructively presented: they form a welcome contribution to the psychology of greatness. In this connection may be mentioned a work on genius,[1] recently published, which, though it makes no claims to be, and is not, a scientific book, touches with a somewhat literary motive on this topic. The writer has made a strong statement of the vanities of eminent men; not of men of genius, however, in any proper sense.

Another peculiar malady which the flesh of the great is heir to, is the 'insanity of power.' The proposition is, that persons in positions in which all their wishes and whims can be put into deeds at once, are liable to become intoxicated with this omnipotence, and to indulge in morbid and cruel practices. The horrible spectacles which the reign of the Claudian-Julian family of emperors at Rome, reaching the climax in Nero, presented to the world, shows the terrible force of this disease, and its hereditary nature. The reigns of Ivan the Terrible in Russia, and of Mohammed Toghluk in India, are other examples of the debasing effects of unchecked power, while the hereditary neurosis of the royal family of Spain illustrates the special dangers to which these select families are subject.

Another line of interest with Dr. Ireland is the study of the relation of the two sides of the body. As the main motor nerves cross from the brain to the opposite side, we are right-handed and left-headed. This predominance of the left hemisphere of the brain is an indication that the two hemispheres only in part are one, and in part are two. Have we one brain or two brains? is, then, not at all an unnecessary question. The peculiar phenomenon of mirror-writing (i.e., of writing from right to left, so that when reflected in a mirror it appears normal), which appears in children and some forms of insanity, has attracted notice to this question. The results as yet are not very definite. Other psychological curiosities, such as sympathetic insanity, which makes whole families go insane at once, peculiar fixed ideas, and so on, are treated in a popular way. The book will not say much that is new, but gives in a very readable form an interesting account of some of the modern phases of psychological thought. J. J.

[1] *The blot on the brain: studies in history and psychology.* By W. W. IRELAND, M.D. New York, *Putnam*, 1886.

[1] *Insanity and vanity of genius.* By KATE SANBORN. New York, 1886.

IRON CONFERENCE AT ST. PETERSBURG.

THE meetings of the Russian iron and coal trades conference at St. Petersburg have been marked, says *Engineering*, by an acrimonious discussion between the representatives of the older Ural establishments and the newer ones in the Baltic provinces and South Russia. The former date from the time of Peter the Great, when that monarch, by generous and well-directed state support, gave such an impulse to the charcoal iron trade that Russia became the leading iron-producing country in Europe. For a considerable period pig-iron was one of the principal products Russia exported to this country. In the beginning of the century, however, mineral coal began to prove a formidable competitor to charcoal in smelting-operations; and ultimately the tables were turned, and Russia received most of her iron from England, instead of supplying her with it. This revolution was marked by the collapse of the Ural iron industry, the ruin of which was accelerated by the wasteful destruction of the forests, and the extravagance of descendants of the iron-masters enriched by the support of Peter the Great. Twenty years ago the Russian government wanted to encourage the manufacture of rails, etc., for the home railways, and, finding the Ural firms disorganized and ruined, created a new industry at St. Petersburg, Briansk, etc., by giving large and lucrative contracts to a number of Russian and foreign capitalists. As coal and iron do not exist in the immediate vicinity of the Baltic, these new ventures were dependent upon foreign iron and coal for their sustenance, and have never been other than weaklings since their birth. The government is now tired of continually altering the tariff, and giving subsidies to these undertakings; and the attitude of neutrality it has taken up has had the effect of placing most of them more or less on the verge of ruin: hence the delegates representing them have been vehement in their demands for support; and, the support they want being precisely the opposite of that which would revive the Ural iron trade, the battle between the 'independent works' (i.e., using only Russian iron and fuel, as in the Urals) and the 'dependent works,' which cannot exist without foreign iron and coal, has been a tough one, accompanied by scenes of personal and undignified wrangling. It is hardly possible for the government to support one without injuring the other; and, as both are equally rotten, it is angrily disposed towards each of the industrial parties. Probably no branch of Russian trade has 'milked' the financial resources of the government more than the iron trade; and prosperity and progress have attended so few of its efforts, that the government is almost tired of dispensing its support.

LONGEVITY.

IT has been stated, with some degree of reason, says the *Lancet*, that the maximum age attainable by man has risen somewhat during the present century over that recorded in former ages. In judging of such statement, some allowance for error must be made. The exact statistical calculations of our day should not, in fairness, be marshalled against the round numbers of less accurate traditions. The fact remains, nevertheless, that the limit of seventy years is now very frequently passed. Fourscore may even be reached by some without excessive labor and sorrow, and we have among us nonagenarians who carry on with still respectable proficiency the activities of their prime. Such effective longevity is a bright spot in the history of our advancing civilization. Its comparative frequency, and its association with different physical types, suggest a certain generality in its origin, and encourage the hope that it may be, in some measure at least, dependent on personal conduct. It has been stated that no such condition can influence the length of life after middle age. After that period, inherited vital force is the only potential factor. To some extent this may be granted. If we fix an average of conduct, and suppose that a number of persons conform to it, we should certainly find the purest and most powerful constitutional types outlive the others. For instance: a gouty tendency does not enhance the prospects of old age. A rheumatic one is little better in this respect. The scrofulous are heavily weighted in the race of life by the chances of several infirmities. Nervous persons, again, are wiry, and may live through much trouble in virtue of their elastic tenacity. Then there are nondescript diatheses, which, except in their remote history, present no definite physical bias. Theoretically, these are most likely to furnish, under ordinary usages, the old men of a given time.

It will be at once evident, however, that these are general statements, and that an unlikely individual will often exceed his own expectation of life, and by care, or from the suitability of his circumstances, will reach old age. In weighing the value of constitutional tendencies, moreover, another nearly related quality should be considered. This is disposition. The mind of a man must be more or less of the nature of his body, and accordingly we expect to find, and do find, that mental habit reflects in preferences, varia-

tions, rate of action, and the like, the type of processes in the lower tissues. So far disposition is merely a part of constitution; and cheerfulness, hope, apathy, or gloom are only expressions of physical change. That all such qualities react upon the body in such a way as to influence its vitality, is undoubted. On the other hand, they may certainly be overruled by the action of the will, so as to be no longer mere bodily impulses, but trained servants of a governing intellect. They may thus acquire a compensatory value in correcting faults of constitution, and strengthen in proportion the tenure of life.

This brings us to the sphere of intelligent effort. There can be no doubt, in our opinion, that there is much room for exercise of private judgment and energy in seeking the prolongation of one's own life. If there is any known diathetic fault, this implies a law of one's being which will repay in a gain of vitality the man who recognizes it, and guides himself accordingly. The doctrine of the 'survival of the fittest' does not work itself out by blind chance, or without evident design, even among the lowest forms of life. Much less is it to be believed that man is unable so to adjust his circumstances to his needs as to continue to live after a certain mean period. The weaker will sometimes prove himself the more tenacious of life by observing rational methods of living, of which the more robust is careless. Moderation has probably more to do with success in this respect than any thing else. To eat sufficiently, and drink stimulants sparingly, to alternate work with adequate rest, and to meet worries heartily, will afford to every one the best chance of arriving at a ripe old age.

Some interesting particulars of the German universities have recently been published by the *London illustrated news*. There are, it appears, twenty-nine now existing, including those in the Austrian empire and Switzerland, and the Russo-German university of Dorpat. Twelve have ceased to exist, with only one exception during the first sixteen years of the present century. The oldest is Prague (1348); the youngest, Czernowitz (1875). Six have been founded during the present century, among them four of the most important, — Berlin, Bonn, Munich, and Zurich. The number of students in the universities belonging to the German empire has risen from 14,808 in 1830, to 23,207 in 1883; but the percentage to the population is exactly the same. This percentage had declined very greatly during the intervening epoch, but has been rapidly recovering itself since the renovation of the German empire in 1871. The percentage of students of Catholic theology has declined during these fifty-three years from 12 to 3, mainly owing to the establishment of seminaries under direct Episcopal control. Protestant theology also exhibits a falling-off in percentage from 27 to 13, but the actual number of students is diminished only by a fourth. Jurisprudence has gained in number, but suffered in percentage. Medicine has more than doubled its numbers, and philosophy nearly quadrupled them, the percentage of the two united being 52, against 32 in 1830. The students of the exact sciences in the philosophical faculty are now 37 per cent, against 13 per cent in 1841.

It has been estimated, says the *New York medical record*, that one-half the adult men of American birth living in our cities are bald-headed. The estimate is not exaggerated, if it is applied to persons above the age of thirty, and it may be rather under the mark. If, now, it be conceded that one-half of our American business and professional men are bald at the present time, it would be interesting to speculate as to the condition of the heads of their descendants some hundreds of years from now. The probabilities point toward a race of hairless Americans, for baldness is extremely liable to be propagated in the male line, and to appear a little earlier in each generation. The American nation is threatened with the catastrophe of a universal alopecia. The cause is usually imputed to the excessive strain and ceaseless mental and physical activity to which our methods of business and modes of living conduce. From the visitors' gallery of the stock exchange, for example, one views a mob of shining pates, belonging, as a rule, to rather young men.

The much neglected scalp should be thoroughly cleansed at certain intervals. It should be carefully and regularly examined, and if it be unhealthy, dry, and scurvy, the proper applications should be made to it. The wearing of unventilated hats is one of the greatest sources of failure of nutrition of the hair, and these must be avoided. The beard never falls out, because it gets plenty of sunlight and air. These are what the hair of the scalp needs also. Women are less bald than men, because, for one reason, their scalps are better ventilated. In fine, civilization has made the hair-producing organs of the scalp delicate and feeble. They have to be nursed and cared for, or they atrophy and disappear. Young Americans who do not wish to lose their hair before they are forty must begin to look after their scalps before they are twenty.

SCIENCE.

FRIDAY, FEBRUARY 5, 1886.

COMMENT AND CRITICISM.

THE INTERNATIONAL COPYRIGHT LAW has received new interest by the introduction of Senator Hawley's recent bill. It is remarkable with what unanimity the better class of authors, periodicals, and publishers have long sought unavailingly the passage of such a bill. In the recent hearing before the senate committee, a number of our most prominent authors spoke in favor of the passage of some law on international copyright. Prominent among those who favored the measures were the Rev. Dr. Crosby, Mr. Henry Holt, Mr. George Ticknor Curtis, Mr. H. E. Scudder, Mr. James Russell Lowell, Mr. Estes, Mr. Samuel Clemens, and others. A memorial signed by over two hundred prominent authors was also presented. The arguments used by these gentlemen were, that the present system of copyright law was not only disadvantageous, but dishonest and unjust; that it worked to the great disadvantage of American authors, and prevented the publication of many meritorious works; that it made books dearer, and lowered our literary taste. Mr. Lowell was satisfied that the reading public of America being much larger, and the demand for cheap books greater, the result of a copyright law would be the transfer of the great bulk of the book-trade to America. Of course, in the passage of such a law, measures should be instituted to protect those who have been encouraged under our laws to become pirates of foreign books. Some, among whom Mr. Clemens may be mentioned, urged that the bill should require all foreign books to be printed here.

THIS COUNTRY IS NOT ALONE in its trouble with the silver question. At the meeting of the council at Calcutta on Jan. 11, the most diverse views were expressed as to the influence the depreciation of silver has had in benefiting the trade of monometallic (silver) India. On this subject public opinion is said to be hopelessly divided. Speaking generally, the commercial men are inclined to agree with Mr. Steel's view, which he upheld at the council meeting, that India is a distinct gainer by the depreciation; while the rest of the community, following the lead of Sir A. Colvin, Mr. Hope, and Mr. Evans, attribute the extension of trade to other causes, and regard the continued depreciation of silver as a most serious danger, calling for careful consideration and prompt action on the part of the home government.

THE GREAT DECREASE in the numbers of many of our birds during late years, brought about in the interests of fashion or other mercenary motives, or through malicious wantonness, has induced the Ornithological union to appoint a committee, composed of a number of our leading ornithologists, on the 'protection of North American birds,' whose object shall be the gathering of information on the subjects of their destruction and protection. The committee will welcome information from any source, and those interested are urged to address such to the officers or members. The secretary is Mr. E. P. Bicknell of New York.

THE INVESTIGATIONS in economic ornithology began under the department of agriculture, July 1, 1885, and have already been successful in bringing together a very large amount of useful material. The scope of the inquiry is, briefly, the collection of all information leading to a thorough knowledge of the inter-relation of birds and agriculture, and concerns both the food-habits and the migration and geographical distribution of North American birds. About fourteen hundred observers are scattered all over the country. Prof. W. W. Cook, superintendent of the Mississippi valley district has prepared a report which is the most valuable contribution ever made to the subject of bird-migration. It is now in the hands of the printer. The English sparrow exerts a more marked effect upon the interests of the country than any other species of bird. The unprecedented increase and spread of this naturalized exotic, taken in connection with the extent of its ravages in certain districts, is regarded with grave apprehension. The study of this little pest developed the fact, that while it does sometimes eat grasshoppers, cicadae, and other insects, the sum of its injurious qualities probably exceeds and outweighs the sum of its

benefits. The Ornithological union has hopes that congress, during the coming session, will provide means for the proper extension of the inquiry. The practical bearings of the investigations are not obscure. When the limitations of the several faunal areas have been ascertained with sufficient exactness, it will be possible to predict the course which an injurious insect will pursue in extending its march from the point where its first devastations are committed; and farmers may be thus forewarned, so that those living in districts likely to be infested can plant different crops, and thus be saved large pecuniary loss, while those living just outside will derive increased revenue from the particular crop affected.

THOSE WHO DO NOT as yet feel sure of M. de Lesseps' ability to carry through his canal from ocean to ocean will be surprised to learn that he is already planning to take part in the long-discussed project of an African inland sea. On the 20th of January a meeting was held in Paris by the promoters of the North African inland sea scheme, at which M. de Lesseps stated that Captain Landas was about to survey the Tunisian oases, and that on his own return from Panama, by April at latest, the company would be formally constituted.

RECENT NUMBERS OF THE *Rundschau* illustrate some aspects of psychological activity to which the German public are giving attention. Professor Golz contributes a lengthy but very well written article on brain localization. Professor Golz is generally regarded as an extreme 'anti-localizationist.' Perhaps the present article embodies his later convictions, in which, though not yielding his former position, he has stated it in a way that allies his opinions with those of other experimenters. He calls his article 'Modern phrenology,' comparing the modern attempt to mark off the cortex of the brain into functional areas to the attempts of Gall and Spurzheim to correlate mental faculties with cranial formations. The cortex is not, according to his views, a mosaic of sensory and motor areas, such as Ferrier, and especially Munk, would have us believe. The experiments do not bear out that conclusion: for the loss of motion and sensation following the extirpation of certain brain areas is not permanent; the function is regained if the animal survives. In many cases the animals have not been kept long enough. The lack of certainty that the underlying fibres have not been stimulated is another objection. Moreover, there is no part of the cortex of which you can say that its removal must cause the loss of sensation or of motion. Not even Broca's convolution, the close relation of which to the language centre has always been a firm support to the localizers, is exempt from this criticism. Professor Golz devotes the main part of his paper to a critical review; in conclusion, however, he suggests what he considers to be the true relation of cortex to function. Flourens thought that the whole cortex was alike in significance: modern 'localizers' hold that no two parts are functionally alike.

The true view lies between the two. If we compare the cortex to a map, Flourens would make no distinction between one part of the map and another. The 'localizers' mark it off into countries; i.e., political divisions, with sharp, distinct boundaries. Professor Golz would mark his map off like those which represent the distribution of plants. In one part the vine would have its centre; in another, rice; in a third, barley: but each would have some vine, some rice, and some barley, although there would be places which would have neither. The boundaries between the regions are loose: we have a focus, but it is not a point. These views are certainly rational, and coincide almost exactly with Lunani's and Exner's results. Perhaps it is not too hazardous to say that a strict localization of function can no longer be upheld.

In the last number, Professor Preyer warns the German public against accepting the results of the English society for psychic research as regards telepathic communication. He explains away the facts upon which their conclusions are based by showing a neglect of the sources of error. In guessing what was being written in another room, the errors made were of such a nature as would occur if the hand had been seen (not errors in the hearing of the words): hence, as the girl who did the guessing was alone in the next room, Professor Preyer ascribes the telepathy to the keyhole. He certainly has made out a strong case, and, what is more important, has shown that the English society has not made its case nearly strong enough to found upon it so alarming an hypothesis as the communication of mind with mind without the use of the ordinary channels of sensation.

At a meeting of the Cosmos club of Washington on Monday, Feb. 1, it was decided to purchase the 'Wilkes' property, on the corner of Madison Place and H Street, a few doors north of the present quarters of the club. The club proposes to build an assembly-room, to be used for receptions and for meetings of scientific societies. The resolution to purchase the property was passed unanimously, and is a move in the right direction. The present quarters are very limited, and, as the club is growing so rapidly, pressing need was felt for more room. The newly acquired property is situated in one of the most desirable localities in the city, and will afford the club many conveniences and comforts hitherto denied them.

AMERICAN FISHERY INTERESTS.

The fisheries-treaty question, which is now the subject of so much discussion, is a very complicated one; and it is not at all surprising that the secretary of state, following traditionary policy of more than a hundred years' standing, and acting upon the long-established theory that participation in the fishery privileges of Canadian waters is of great value, should have failed to satisfy the expectations of the New England fishermen, who know so well that these privileges have long been valueless. A general impression seems to exist that our fishing-fleet no longer visits the Gulf of St. Lawrence, only because there has been a temporary desertion of those waters by the species of fish which they seek. Such, also, is the idea of the Canadians. In his recent article in the *North American review*, Lord Lorne patronizingly suggests to his 'good friends' across the line that they should not be too hasty in throwing aside the right to fish in English waters, because the fish may before long return in their former abundance.

As a matter of fact, the abundance of fish in the Gulf has very little to do with the question as it now presents itself. Since 1871, when the Washington treaty was negotiated, a complete revolution has taken place, both in the fisheries and the fish trade of the United States; and, strangely enough, this revolution was effected chiefly in the six years which intervened between the completion of this treaty and the meeting in 1877 of the Halifax convention, by which $5,500,000 were awarded to Great Britain as a compensation for a concession to our fishermen, which had ceased to be of value to them, in addition to the remission of duties on Canadian fish, which during the period of fourteen years have amounted to several millions of dollars. Our government has thus, unintentionally of course, been paying each year a large subsidy to the fisheries of British North America, and developing the Canadian fisheries at the expense of our own; and Canadian competition has become so great that our fishermen feel that they have a strong claim upon the government for some kind of protection. The fishermen therefore demand that the duty upon Canadian fish be restored, and that their own privileges shall be based upon the provisions of the treaty of 1818, which will again go into effect, if no new treaty arrangements are made. Our dealers in cured fish, on the other hand, mindful of the profits of handling the product of the Canadian fisheries, are clamorous for a continuance of the present free-trade policy.

The revolution in the American fisheries is so extensive that it can scarcely be discussed in a notice so brief as this. One of the principal changes is the adoption of the purse-seine in the mackerel fishery, by which the fish are caught far out at sea and in immense quantities by enclosing them in an immense bag of netting. Formerly they were taken solely with hooks by the 'chumming' process. This was in the best days of the Gulf of St. Lawrence mackerel fishery, when hundreds of American vessels would frequently lie side by side, throwing overboard vast quantities of oily, mushy bait, by which the schools of fish were enticed within reach. There is no reason to doubt that mackerel were as abundant then as now off our own coast, but the old method of fishing was not so well adapted to our waters. The purse-seine, on the other hand, cannot be used advantageously in the Gulf, nor is there any necessity for our fishermen to go so far from home for their fish. There does not appear to be any probability that our fishermen will ever return to the old methods. 'Chumming mackerel' is essentially a lost art.

Another feature in the revolution is the introduction of improved methods of marketing fresh fish. With the extensive refrigerating establishments now in operation, and the facilities for rapid transmission of sea-fish inland, the demand for salted fish is relatively very much less than it was fifteen years ago. Then, too, the immense competition produced by the free entry of Canadian fish has lowered the price of cured fish, until a very decided depreciation in its

quality has resulted, with a consequent decrease in demand.

The present condition of the sea-fisheries of New England is a deplorable one. Whatever is to be done for their amendment, it is to be hoped that our diplomatists will not suppose that they will profit by the privileges of free fishing in Canadian waters.

ELEMENTARY SCIENCE-TEACHING.

FROM all sides comes the advice to study science. Teach science to children, put it in the kindergarten, double the amount of it at college, and foster it at the universities. The opinion seems to be current, that, by introducing a branch of science on the school curriculum, the magic effect is to be won. To give children objects to handle, to see, to describe, and to puzzle over, is certainly an excellent discipline.

But the far-famed benefits to be derived from science do not centre there, nor is it with the methods of teaching science that fault is to be found. The methods have been carefully worked out: models, diagrams, specimens, excursions,—all are pressed into service; and, though the results of this world-wide scientific movement have been great beyond all expectation, one will readily accept the statement that elementary science-teaching — excepting to elementary learners, children just beginning their school education — is not always gratifying work. To school-children who have already received their formative training, — who have swallowed, perhaps digested to a greater or less extent, the usual doses of book-learning, — whose minds have been set in the rut of an arbitrary bookish study method, the introduction of a science course often brings more pain than pleasure.

A case in point recently came under my notice. At a school for girls, an able and interesting lecturer gave a course in physiology. The lectures were illustrated, and well-directed efforts were made to make things clear. Recently an examination was held, and perhaps it will be worth while sampling some of the more characteristic answers to the questions then asked. The stomach is put 'in the chest,' or 'is covered by a muscular bag called the pericardium,' or 'is mostly on the left side, just south of the heart.' The authority for the last statement also showed an indignant surprise at being told that her heart was nothing but a muscle. Another anatomical fact not yet recognized by the text-books is that 'the scapula has no shape.' 'Capillaries are small particles in the blood,' or 'are depressions in the arteries, and they change the fatty parts into blood.' Some feats of swallowing and digesting are described. 'The food passes from the mouth through the blood to the stomach,' or 'is attracted downwards, and then your Adam's apple slips over it:' 'it passes first to the small, then to the large, intestine.' The surgery is also peculiar. When an artery is partly cut, you are advised 'to cut it open so as to prevent the loss of too much blood.' or 'to cut it entirely so as to allow it to coagulate.' The terms, too, are caught up inexactly and without definite ideas: 'vains,' 'venus.' 'gaul,' 'color-bone,' 'clerical' (for 'cervical'), 'ablutions' (for 'albumen'), 'humerous' (for 'humerus'). By a peculiar association of ideas, the young lady responsible for the last innovation states that this bone is commonly called the 'crazy' bone.

On the whole, the answers were very good. Those given above are purposely selected for their peculiarity. The girls too, with some exceptions (mostly from twelve to sixteen years of age), took great interest in the subject. Nor is the school to blame. The early training of these girls was entirely opposed to these new methods of teaching. It is not the science that is strange to them; but there is a struggle going on in their minds parallel to the battle between the 'new' and the 'old' educationalists in the reviews. This leads to a confusion of thought, a muddled-headedness, which perhaps is the most characteristic feature of the above answers. The whole moral can be summed up in one phrase. It is not in the direction of science-teaching, but of scientific teaching (and that, too, from the cradle onward), that the future of education is to develop.

With the above experience fresh in mind, I came upon a second example of elementary science-teaching, of a most ingenious kind. It is nothing less than an attempt to give to children an account of the physiology of the brain (Frank Bellew, *St. Nicholas*, February, 1886). The 'firm of Big Brain, Little Brain & Co.' tends to the business affairs of the body. The cerebrum is the administrative department. There the head of the firm, old Big Brain, sits at his desk surrounded by papers and all the appliances of a modern business-office. At one side is a telegraph-key to bones; on the other, pigeon-holes and register cases. Below him, on one side, is Little Brain, (the cerebellum), a little elf tending to the machine; on the other, the ganglia, or gang of five clerks on high stools. These put down the accumulated expenses of Big Brain, and do the book-keeping. One of the little band is in the office receiving an order from Big Brain. In the middle is the Bridge (Pons), keeping up a continual clatter of telegraph-keys, transmitting messages from one part of the brain to

another, in all directions; and still farther down is Medulla. He has charge of the life department, and keeps working the bellows, and running the fire of life. And through this allegory you are to 'know more about the contents of your knowledge-box than you did before.' Only a reading of the article itself, and an enjoyment of the grotesque illustration, will convey an idea of its extreme clearness; and, after such a reading, no excuse will be necessary for calling attention to this effort as an illustration of modern elementary science-teaching. Joseph Jastrow.

TOTAL-ABSTINENCE TEACHING IN THE SCHOOLS.

In 1884 the legislature of the state of New York, in response to forty thousand petitions, passed an act by which all schools supported by public money or under state control are required to instruct their pupils in physiology and hygiene, "with special reference to the effects of alcoholic drinks, stimulants, and narcotics, upon the human system," and prohibiting the granting of a certificate to any person to teach in the public schools except after passing a satisfactory examination in physiology and hygiene with special reference to the effects of alcoholic drinks, etc. A similar law has been passed in at least fourteen states of the union. This action, it is claimed, is due to the Woman's Christian temperance union.

It was at one time questioned whether such a law was constitutional, and how far it could be enforced. The state superintendent, W. B. Ruggles, in a letter to Commissioner Perrigo, at Potsdam, says that it is the duty of the local school authorities to provide for such instruction; the duty of the teachers to give the instruction; and the duty of parents to cause their children to conform to the course of study in these subjects, as in any other studies prescribed under the law. He goes still further, in declaring that a persistent refusal of a pupil to receive instruction in physiology or hygiene may justify the school authorities in excluding such pupil from the benefits of the public schools. A similar question has arisen in reference to the vaccination law in the state of New York, passed in 1860. In that law the legislature distinctly authorizes and directs the exclusion from the public schools of children not protected from small-pox; and, so far as we know, this power and duty have never been abridged or questioned by the courts. It would seem, therefore, that the conditions under which children may participate in the benefits to be derived from being educated at the public expense are lawfully within the power of the legislature to prescribe, provided always that constitutional provisions are not violated.

The immediate result of the passage of these compulsory laws has been to cause a remodelling of the text-books of physiology and hygiene in order to meet the requirements of the legislatures. Some of these have been but little changed, except to be enlarged by a few chapters on alcohol and tobacco: while others have been entirely rewritten with the special object of making them conform to the new demands. It is the opinion of at least one lawyer, reputed to stand high in his profession, that the main object of these statutes is to provide for scientific temperance instruction in the schools; that the use of works on physiology and hygiene is a mere method of accomplishing this result; and that any instruction which, while making physiology and hygiene its leading feature, only incidentally bears upon alcohol and narcotics, is not a compliance with the law, and therefore school authorities are only justified in using as text-books those which make the effects of alcoholic drinks, stimulants, and narcotics upon the human system their special object. If this opinion is correct, very many of the books which have been recommended for introduction into the schools since these compulsory laws were passed would be discarded, as they are primarily works on physiology and hygiene, and secondarily teach temperance. The number of books which have thus far appeared to meet the new demand exceeds twenty.

One of the most prominent temperance writers thus explains the failure of temperance movements hitherto, and points out what he thinks to be the hope of the future.

"The temperance efforts of the past failed because all temperance decrees proceeded from the sovereign, and were as changeable as his whims and caprices, and also because it was not known that alcohol was always a poison. The modern temperance movement is based on knowledge and on a sentiment of fellowship and fraternity. The great advance made in physiological science has been applied to the study of the effects of alcohol upon the human system, and from this the most beneficial results may be expected. Based upon the statement of Tschokke, that all laws are powerless for extinguishing an evil which has taken root in the life of the people, it is from the people itself that the reform of morals must proceed, but no government is strong enough to bring it about."[1]

It is as yet too early to judge of the wisdom of this new departure. The teachers themselves must first be taught; and the movement towards

[1] Gustafson, in 'The foundation of death.'

temperance reform will therefore practically begin in the normal schools, to spread thence to all the public schools throughout the various states in which these compulsory laws have been enacted. The receptivity of the young mind is greater than most persons are aware of; and while, at first thought, the instructions of pupils of the age of six years as to the effects of alcohol and tobacco would not seem to promise very great results, still more may be accomplished than would be anticipated. Inasmuch as the end aimed at, if reached, would contribute beyond all calculation to the prosperity and welfare of the human race, the experiment is one which should receive every aid and encouragement possible. It would not be strange if the enforcement of the law demonstrated defects: when these become evident, they can be remedied. If legislators passed no law until it was perfect, the country would be deprived of much useful and needed legislation. D.

NOTES AND NEWS.

COMMISSIONER COLMAN of the agricultural department left for St. Louis on Monday to preside over the conventions of the National sugar association and the Mississippi valley dairymen's association, which are to be held this and next week. At the latter convention the commissioner proposes to show the delegates the progress he is endeavoring to make in the investigations of the adulteration of food, especially of dairy products. Professor Taylor, the microscopist of the department, who claims to have discovered an unfailing test for pure butter as compared with the counterfeit article, will be present, and by means of a magic lantern and a series of micro-photographs will explain the discoveries, and make an address. It is understood that the department is not ready to indorse these discoveries as being absolutely without question; but the commissioner thinks that the convention is entitled to such information as he can furnish, and that the country ought to have the benefit of such suggestions as Professor Taylor has to make.

— A letter from Panama, under date of Jan. 24, states that a government commission, consisting of Professor Rockstrock and Mr. Walker, has been sent from Guatemala to report upon the probability of an outbreak of the Pacaya volcano. The report of these gentlemen announces the total destruction of the village of San Vicente Pacaya. Some forty-four tiled-roof houses completely collapsed, making such a cloud of dust as to create a belief that a new crater had opened. The hot springs surrounding Lake Amatillan emit a larger volume of water, at a higher temperature, than usual. The crater of Pacaya remains unchanged, while that of Fuego has been very lively.

— The invention of Mr. Edison for sending and receiving messages on a moving train was successfully tested, Feb. 1, on the Staten Island railroad. The operator sat in the middle of the centre car of the train, before a desk furnished with a Morse telegraphic key. He held a telephone at each ear. Under the desk was a battery. From this a ground wire was connected with the car-axle and the rail. Another wire passed through the key and to the roof of the car, which was connected with the roofs of the other cars by short pieces of copper wire. Parallel with the railroad were the telegraph wires of the Baltimore and Ohio company. The induction between the metal roof and the telegraph wires was sufficient to allow of the reception by telephone of Morse signals.

— Professor Fuchs, in his twentieth annual report on the seismological events of 1884, gives 123 shocks of earthquakes, distributed in time as follows: winter, 57 (Dec., 19; Jan., 28; Feb., 10); spring, 24 (March, 13; April, 7; May, 4); summer, 21 (June, 5; July, 9; Aug., 7); autumn, 21 (Sept., 8; Oct., 1; Nov., 12). Those deserving individual mention are, March 24, in upper and central Slavonia, where in Diakovar and other places numerous buildings suffered injury; April 22, in England; May 13, in Crevassa, where a church and other buildings were destroyed; May 19, on the Persian Gulf, in which two hundred persons fell victims by the overthrow of their houses; Aug. 10, in the eastern United States; and the Spanish earthquakes in December. In regard to the last, Dr. Fuchs believes the centrum was not a point, but a line parallel to the Sierras Tejeda and Almijara; nor does he think they were of greater importance than those of Belluno in 1873, of Agram in 1880, and of Chios in 1881. There was very little volcanic activity throughout the year, and that only in Aetna, Vesuvius, and St. Augustin, in Alaska.

— Mr. R. L. Harris has lately read a paper on two Daft electric motors, used on the Baltimore street-railways, before the American society of civil engineers: he reports both of these motors as being very successful in all weathers and conditions of the track. The grades are very steep for motors, reaching three hundred and thirty feet per mile in some places; nevertheless these motors have at no time failed to pull overloaded cars with perfect ease. These motors do the work of fifteen horses each, at an average daily running expense of $4.62 for fuel and attendance.

— The recent experiments of the Franklin institute, upon incandescent and arc lights, give the

following averages: one pound of anthracite burned under a good boiler yields, in the incandescent system of lighting, about 40 candles; the same weight of coal gives from the naked arc-light about 158 candles; ordinarily arc-lights are shaded so as to lose about one-half their intensity, so that only 80 candles per pound of coal are available; one pound of bituminous coal will yield from five to six cubic feet of illuminating-gas; this gas will, in the standard argand burner, yield from 14 to 17 candles. Illuminating-gas is burned at once in the simplest manner, and the amount of machinery and care required by electric lighting offsets its greater economy of fuel, light for light. There is little room for improvement in dynamos, but the most important economies will arise from more skilful use and design of the steam-engines required to drive the dynamos. The steam-engine, although much the senior of the dynamo in the list of inventions, is not nearly so well understood. It is but very recently that the laws of condensation and expansion of steam in the engine actually at work have been grasped, and our limitations so clearly defined as to point out the logical way to greater economies, and prevent us from attempting economy under impossible conditions.

— The photograph of the normal solar spectrum, made by Prof. H. A. Rowland at the Johns Hopkins university, Baltimore, is now complete from wave-length 3680 to 5790; and the portion above 3680 to the extremity of the ultra-violet, wave-length about 3100, is nearly ready. Negatives have also been prepared down to and including B, and it is possible they may be prepared for publication. The plates, seven in number, all contain two strips of the spectrum, except No. 2, which contains three. They are three feet long and one foot wide. These can now all be furnished to order except No. 2, the negative of which is being made. The plates will be delivered in Baltimore or New York, or will be sent by express or mail, securely packed, at the charge and risk of the purchaser, at the following net prices: the set of seven plates, unmounted, $10; mounted on cloth, $12; single plates, $2 each; mounted on cloth, $2.25.

— A telegram from Guayaquil, of Jan. 20, announces that indications of an earthquake were observed in Chimbo contemporary with a renewed outbreak of the Cotopaxi volcano.

— There are good reasons for supposing that a bill will pass both houses of congress, appropriating fifteen thousand dollars annually to Cornell university for the establishment of an agricultural experiment-station at that institution.

— The Norwegian ship Ferdinand at Philadelphia reports that near midnight of Jan. 8, in latitude 38° 20′ north, longitude 71° 20′ west, during a severe storm of rain and wind, the night being very dark, all the yard-arms and mastheads were suddenly lighted up with St. Elmo's fire, having the appearance of bright lanterns. The phenomenon lasted about three minutes.

— The opening of the third electrical exhibition at St. Petersburg, which took place on Jan. 1, is attracting much attention among the people, especially that portion devoted to the telephone. The exhibition is said to be noteworthy for the novelty, variety, and number of its objects. For illumination, all the known systems of electrical lighting are employed.

— The *Kölnische zeitung* for Jan. 14 states that at the preceding meeting of the Vienna geographical society was announced the discovery, by Dr. Stapf, of a hitherto unknown lake in the Persian desert. The lake, according to Dr. Stapf, is at least forty kilometres long, and is probably of recent origin. According to information obtained from Mohammedan sources, it appears that the lake dried up after a previous existence, and later re-appeared. The water is to a very considerable degree alkaline.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The competition of convict labor.

The two articles which have appeared in *Science* on this problem (vii. Nos. 153 and 155) by Mr. N. M. Butler treat this subject after the manner of that system or school of political economy which is taught in the colleges, and which rules in business. Its aim and end is profit. It is science 'for revenue only,' and it ignores morality or humanity. It judges all human activity by the standard of profitableness. In reference to this particular question, Mr. Butler formulates that stand-point very characteristically by the following initiatory axiomatic phrase: "That convicts should be employed, if possible, in a manner profitable to the state, is a proposition that no sane man controverts."

To be sure, any thing humane is sentimental nonsense to this school; and any thing so 'unbusinesslike' as the greatest of virtues, charity, is insanity. But this form of 'insanity' is increasing rapidly in the world, and developing a new school of political economy, whose central principle is to further the welfare of all men. From the stand-point of that school, a prison should not be a slave-pen for grinding out 'profit' to the state, but either a refuge for moral cripples or a school for those who lack the moral training necessary to make them good citizens.

About the cause of the agitation of this question among workingmen, Mr. Butler makes some state-

ments which are apt to be misleading. He ascribes it to a few isolated individuals and to sustenance-seeking agitators. The facts are, that whole groups, trades, have directly been affected wherever prison labor has entered the market. The statement which contractors are said to make, that convict labor at fifty cents a day is not cheaper than free labor, is not to be believed except upon the most positive evidence, for the prisoners are driven and tortured to daily perform a set task; and that this is not an average half-day work is pretty safe to surmise.

As to the selfish 'agitator,' he is the great bug-a-boo of those who do not know him, or whose interests are threatened by him. The truth is, that his is a losing business: he is persecuted, blacklisted, hunted, and misunderstood and denounced; and that he still remains true to what he deems his duty is a trait that should be honored by all who can appreciate an unselfish action.

The real stand-point of the humane school and its agitators is, that 'prison labor must go,' in so far as it is directed to the production of wares for the general market. The piece-price plan and similar tub-to-the-whale measures will not stop this agitation. The employment of prisoners towards their own support directly, as food-raising, prison-building, etc., or their employment on public improvements, is the only thing that will divert the rapidly increasing political activity of workingmen as a class from this 'agitation.' E. LANGERFELD.

Your correspondent misses entirely the tenor of the articles referred to. They were not written from the stand-point of any school of political economy whatsoever, but from the stand-point of practical ethics. That convicts are to be subjected to reformatory and ennobling influences is a truism which my articles took for granted. That idleness is an ennobling influence, that productive labor on the part of convicts is of no injury to the community, were the two points which I was concerned to establish. Dogmatic statements in regard to competition of convict with free labor cannot stand in the face of the figures adduced in the second article (*Science*, vii. p. 68), which were in every case official. Having established the fact that convicts are best employed in productive industries, it only remains to determine from the facts, not theories, which of the systems is the best. This is, I claim, the contract system, when it is properly administered. The question of prison labor is a large one, and, in the articles criticised by your correspondent, but a small portion of it was touched upon. NICHOLAS MURRAY BUTLER.

A tornado brood in Hampshire county, Mass.

The facts recently published, showing the wide distribution of tornadoes along the south-eastern border of a stormy area of low barometer, and the further evidence that they occur with special frequency but at no fixed points in certain regions, throw no light on observations made incidentally by me during a residence at Amherst, Mass., from 1870 to nearly 1880. I write this with the hope that persons in the central and western parts of Hampshire county, Mass., will for several years make and record observations of a storm breeding-place to be now described, and note the day and hour, so that the results can be compared with a series of signal-service weather-maps. Some immediate comparison can also be made by noting down at the time the newspaper signal-office report. I have something to say, also, of the peculiar storm or wind-gust that destroyed Northampton bridge in 1877.

My house at Amherst, on 'Mount Pleasant,' commanded the Connecticut River valley for nearly the entire width of Massachusetts. Directly west of me, on a line with the foot of the steepest northern slope of Mount Warner, but west of the river, was what I may term a 'cloud nursery;' not that I remember it as conspicuously originating clouds in a fair sky, but rather and very often as strengthening, enlarging, darkening, any floating cumulus or cumulostratus, and seemingly arresting and holding it there until it became sometimes a rain-cloud, and, in three or four instances, a tornado. It seemed to be over or little beyond the hills west of Hatfield. My impression was, that it must be somewhat beyond: namely, over the Mill River valley in the vicinity of Williamsburg. The hills thereabout are not high, not as high as others visible in the Green Mountain range, beyond and to the north. My theory is, that warm, moist, southerly winds all the way from Connecticut, through the wide valley of Southwick, Westfield, Southampton, were thrown upward in the narrowing Mill River valley, which runs north north-west from Northampton, and so moisture was condensed in the upper air, the upward current at times inviting toward it a tornado inrush of colder air.

Certainly it was just there that two tornadoes by day, and probably one in the evening, originated, Sept. 4, 1873. The apparently stationary cloud had been for some time increasing and darkening, when, soon after noon, I noticed a portion of it hanging down like the inverted crown of a low-crowned hat; and, not long after, the cloud seemed to begin a movement towards the north-east, until, as it approached Whately, the increasing downward projection became ragged at the edges, and two opposite motions of the wisps indicated a whirl. For a moment an ascending funnel from the Connecticut River, near Sunderland, met the descending one from the cloud; and, soon after, the now large and wild whirl struck a shoulder of Mount Toby, levelling a strip of forest, and doing much damage in the village of Long Plain, bounded up the hills east of that, and nothing more was seen or heard of it. The second tornado, an hour later, starting from the same centre, was less threatening in appearance, passed over North Amherst, about seven miles south of the first, and reached the earth only as a harmless gust of wind. A third fell on Northampton at 8 P.M., prostrating many of its grandest elms. There was a fourth, somewhat destructive, at Granby, Mass., just south of the Holyoke range, at 3 P.M, simultaneous with the one that moved over North Amherst. This one at Granby, originating at another point in Hampshire county, and the fact that my pocket-diary notes a storm and violent wind visible in the far north on the following day, suggest some general conditions in the atmosphere favorable to tornadoes, but do not alter the fact that I saw ordinary clouds increase on a day of seemingly ordinary weather, at the spot mentioned, and convert themselves into tornadoes at 1 and 3 o'clock on the day named.

That there may be another local centre south of the Holyoke range, in the region of Granby, is probable from the fact that in 1872, Aug. 16, there was an isolated tornado at Wilbraham and Longmeadow. My note-book, in this connection, only speaks of

heavy rain the 14th and 15th, and on the 16th records 'rain about every P.M. this summer.'

The remarkable gust of rain and wind that wrecked the long bridge over the Connecticut River, and many fine elms there and in Hadley, June 14, 1877, began as the usual darkening of more or less general and ordinary cumulo-stratus at the same centre near Williamsburg. It seemed hardly moving, with a slight sheet of rain, for a while, and then I noticed its rather rapid increase of size and motion. It expanded south-east, in shape like a ploughshare, and its accelerated movement down the hill-slopes toward Northampton became exciting to witness. There was nothing like a downward-reaching funnel; but the whole rain-cloud was near to the earth, and, for a while before reaching the river-bridge, there were, in front of the cloud, wisps of cloud that moved rapidly upward, backward, and downward, as if around a horizontal axis. After passing Hadley, it exhibited no features different from a common rain-cloud, and passed off over the Holyoke range.

Files of signal-service weather-maps may be consulted for the days above mentioned; and citizens of Northampton may recall enough to show whence the tornado came on the evening of Sept. 4, 1873. The hotel on Mount Holyoke would be an excellent post of observation to exactly locate and watch the cloud-intensifying spot above described.

H. W. Parker.

Grinnell, Io.

Tadpoles in winter.

A few days ago one of my students brought me three large tadpoles, seven centimetres in length, from a well in a depression in an open field. The well overflows in the spring of the year, and the water this winter has been quite cold, yet the tadpoles do not seem torpid at all, but swim freely about.

I had always supposed that these animals could only live in the warmer months of the year, and would like to know if any readers of *Science* have ever found them alive during the winter.

H. M. Hill.

Watertown, N.Y., Jan. 30.

A monument to de Saussure.

The month of August, 1887, is the centenary of the ascent of Mont Blanc by de Saussure, the first to accomplish it after Jacques Balmont, the guide, whose success of the previous year had been stimulated by de Saussure's offer of a prize for the discovery of a practicable route.

The commune of Chamonix, with the co-operation of the French alpine club and others, proposes to erect a monument to the eminent geologist, physicist, and explorer. American contributions toward this object will show our appreciation of the character of the man, and the value of his work.

The Appalachian mountain club, in response to solicitation from the French society, will take pleasure in transmitting donations, which may be sent to the corresponding secretary, Prof. Charles E. Fay, at the club-room. Owing to delay in receiving the invitation, replies must be immediate, as the lists are open abroad only until the close of the present month.

J. Rayner Edmands,
President.

The Appalachian mountain club,
7 Park Street, Boston, Mass., Feb. 2.

The Davenport tablets.

In the issues of your journal for Dec. 25 and Jan. 1, Rev. Cyrus Thomas, of the Bureau of ethnology, directs attention to the Davenport tablets, and seriously questions their authenticity. In entering upon this undertaking, Professor Thomas stated, that, to properly discuss the question of their genuineness, "a personal inspection of the relics, and a thorough investigation of all the circumstances attending their discovery, should be made;" and then he added, "I do not claim to be thus prepared." Probably no writer ever before set out to prepare a piece of 'destructive criticism' with so frank a confession of his disqualification for the task.

In his arraignment of our relics, Professor Thomas charges upon them these grave offences: that on the limestone tablet the sun is represented with a face, and that the artist has carved thereon the 'Arabic 8' and the 'Roman numerals viii;' that on the shale tablets there are also 'three Arabic 8's;' that nearly all of the letter characters of the 'cremation scene' may be found on p. 1766 of Webster's Unabridged dictionary, edition of 1872; and that the two forms of the 'Gallic *O*' appear together on the tablet just as given on the page of the dictionary. These are fair specimens of the arguments by which Professor Thomas attempts to controvert the unimpeached statements of the discoverers. The resemblances indicated are so trivial and purely fanciful as to scarcely attain the level of serious criticism. If Professor Thomas will take the Grave Creek tablet, or even the famous Rosetta stone, and sit down before them with his 'Webster's Unabridged,' he will find no end of similar resemblances. A single glance, for instance, at the Grave Creek tablet will reveal the 'Arabic 4,' twice repeated, and he will find his arguments equally forcible if applied to it. In answer to the accusation that the sun appears with a face, it may be said that this is not uncommon in Indian pictography.

In his impeachment of the limestone tablet, Professor Thomas then advances this argument: "The simple fact that the vault under the pile of loose stones was empty, save the presence of the relic, appears to absolutely forbid the idea of age. It is well known to all who have taken any part in excavating, that the water running down through earth, and a pile of stones beneath, will at length fill all the crevices with earth, and, in fact, all places not hermetically sealed."

It will be noticed that Professor Thomas speaks of this limestone tablet being 'under a pile of loose stones,' which is an inaccurate statement, inasmuch as the vault wherein it was placed was entirely covered by a limestone slab, now in the museum of the academy. Therefore, so far as any direct descent of water was concerned, this vault was practically 'hermetically sealed.' If water entered at all, it must have been horizontally through the wall of loose stones at the sides. The crevices in this wall were filled with decayed shells, and, as most of the water falling upon a mound would pass off on the surface, the small amount of moisture absorbed into its substance would not 'run down through the earth' at all, but instead would slowly percolate from grain to grain of sand or clay, which, having no current like 'running water,' could transport little or no earth. Apparently no good reason can be given why a vault so protected from above, as well as at the sides, could not remain empty for ages.

The literature of archeology, it will be found, furnishes strong support to this conclusion. For want of space, only a single brief reference will be made at this time. Dr. Joseph Jones, in describing a mound opposite the city of Nashville, says, "This stone grave, which was about two feet beneath the surface, had been constructed with such care that little or no earth had fallen in, and the skeleton rested, as it were, in a perfect vault." According to Professor Thomas, the fact that this grave was unfilled with earth would indicate that the 'corpse' was a modern plant, placed there for purposes of deception.

Professor Thomas then cites, as a witness against us, one of our own members, a Mr. A. S. Tiffany. It is therefore proper to state that this venerable gentleman has a grievance against the academy. During the preparations of its first volume of Proceedings, Mr. Tiffany presented for publication a geological paper containing a list of the fossils found in this vicinity, which, after careful examination, was, for good and sufficient reasons, declined. This so offended him that he withdrew from active participation in its proceedings, and ever since has never missed an opportunity to defame his old associates, and denounce its management. It is only necessary to add that he is not an archeologist, was not present at the discovery of the tablet, never examined the mound from which it was taken, and hence his mere opinion can have no scientific value.

Nevertheless, Professor Thomas makes this secret letter of Mr. Tiffany's the corner-stone of his argument. As I have before me a copy of this letter, received through the courtesy of Professor Thomas, I speak advisedly when I state that the quotation used by him is not correctly given. There are in it no less than four alterations of the text. The original indicates illiteracy, whereas the quotation as given by Professor Thomas has all the polish of his own excellent composition. Professor Thomas, moreover, seeks to create the impression, that, inasmuch as Mr. Tiffany was a prominent and active member of our academy, therefore his opinions as stated in this letter should be received as authority; and yet, strange to say, in the very last sentence of this same letter, Mr. Tiffany announced his separation from the academy, and his determination to have nothing more to do with it. Nor is this all. In this identical letter, Mr. Tiffany wrote as follows concerning the shale tablets: "Those shale tablets, I have the utmost confidence that they are genuine. I examined the situation when they were first obtained." Mr. Tiffany never examined the mound from which the limestone tablet was taken, but still he is 'certain' it is a fraud: this Professor Thomas quotes. Mr. Tiffany did examine the mound from which the shale tablets were taken, and pronounces them genuine: this Professor Thomas omits. I am therefore compelled to pronounce the use made of this letter by Professor Thomas as unfair, and his quotations from it as garbled. I would not willingly do him any injustice, and hence now call upon him to publish this letter *verbatim et literatim*. If he will have a facsimile of it prepared by photograph or any other process, and furnished to *Science* for publication, I am prepared to say that such publication would not only destroy its value as authority, but would subject Professor Thomas himself to censure in resorting to such sources for scientific material. To facilitate such publication, I will add, that, if it involves expense not properly belonging to the bureau, I will engage to deposit with the editor of *Science* the necessary amount to meet it. I am of course unable to make any such publication myself, inasmuch as the original letter is in the possession of Professor Thomas, and no copy can do it justice.

Before closing this paper I desire to add a few observations concerning the shale tablets. In order to secure a thorough investigation of their merits, they were sent, soon after their discovery, to the Smithsonian institution, where they remained during a session of the national academy, and were then inspected by its members. In a letter bearing date April 11, 1877, Prof. Spencer F. Baird, secretary of the Smithsonian institution, in acknowledging the receipt of the tablets, said of them, "There seems every indication of genuineness in the specimens, and the discovery is certainly one of very high interest;" and after a more careful inspection of them, and their exhibition to the members of the national academy, the tablets were returned to Davenport; and in his letter bearing date May 31, 1877, Professor Baird thus states his conclusions thereon: "Most of the persons who examined them, among whom were Professor Haldemann, Mr. Lewis H. Morgan, and others, were of the opinion that they were unquestionably of great antiquity, the absolute period of which could not, of course, be measured. The similarity in the weathering of the inscriptions to that of the rest of the tablets gave them this impression." With this favorable indorsement of such men as Prof. Spencer F. Baird, Professor Haldemann, and Lewis H. Morgan, the Davenport academy felt secure in the position it had assumed, and thereupon published its discovery to the scientific world.

In a recent correspondence with Professor Thomas, I learned of his intention to write these papers against the authenticity of the relics in question, and I then submitted to him that it would be manifestly unfair to do so without some previous investigation. I even brought the matter before our academy, and had this resolution adopted, and personally transmitted the same to Professor Thomas at Washington: —

"Whereas the correspondence of Prof. Cyrus Thomas with President Charles E. Putnam has been submitted to the academy, therefore be it resolved, that the academy extends a cordial invitation to Prof. Cyrus Thomas, previous to his proposed publication, to visit its museum, inspect the relics under discussion in the correspondence, examine the mounds where they were discovered, interview the finders, and investigate all available evidence."

This invitation certainly indicated confidence in the genuineness of our relics, and our willingness to have them subjected to the most searching scrutiny. The invitation, however, was, on behalf of the bureau, curtly declined, and on the part of Professor Thomas indefinitely postponed. Apparently our Washington friends are so anxious to condemn, they are afraid to investigate. CHARLES E. PUTNAM,

President Davenport academy of sciences.

Davenport, Io., Jan. 15.

Topographical models or relief-maps.

In Nos. 153 and 154 of *Science*, reference is made to the use of exaggerated vertical scales in the construction of relief-maps or topographical models; and, as you have been good enough to refer to a piece of work in this line done by myself and wife, — but which is as yet private property in my study, and not

upon the market, as might be inferred from your criticism, — I trust I may be allowed a word relating thereto.

There are various uses for topographical models, and that for which they are designed must necessarily govern their construction. While the technical geologist, in considering orographic questions, finds it undesirable to exaggerate the vertical scale of his cross-sections, such profiles would be absolutely useless in the actual construction of a railroad. It should be equally evident that the needs of school-children under sixteen years, and those of the field geologist, are not necessarily met by identical appliances. The construction of suitable topographical models for use in the common schools is educationally of the utmost importance, and, now that the matter has been referred to, I hope it may receive the consideration it demands. Almost every great physiographic and commercial problem requires the pupil to see his locality and state in its vertical relations to other states and countries; and how best to enable him to do this, is not solved by Professor Lesley's dictum.

What we need to-day for educational purposes, as I see it, is an accurate topographic model of every state in the union, constructed in such proportions as will enable the pupils, in their respective schools, to use it as a working-plan for the making of a larger model of their state. This map should not be isolated. The pupil must see it in its horizontal and vertical relationships to other states. Now, to meet these demands, a relief-map of the United States is required, in which both the horizontal and vertical elements for each state may be measured with sufficient accuracy and facility by the pupil. Such a model must be portable, very strong, and *extremely cheap*. I emphasize the last, because, unless they are cheap, the schools needing them most cannot have them. Now, a model of the United States might be constructed, as Professor Lesley suggests, but it would be useless for topographic purposes if made of any portable size. Our own map has the horizontal scale sixty-five miles to the inch, and it is certainly as large as can be conveniently handled in the average schoolroom. But taking the Grand Cañon district as an example of what might be done with both scales alike, using Mr. Dutton's profile, extending from the Markagunt plateau southward across the Grand Cañon, for data, we should have the following profile: —

1. Markagunt plateau	10,568	feet	above sea-level,	or		.0295	inch.
2. North bank of Parunuweap	4,659	"	below (1)	"	"	.0138	"
3. Depth of bed of stream....	1,250	"	" (2)	"	"	.0036	"
4. Height of Vermillion Cliffs	1,818	"	above (2)	"	"	.0053	"
5. Foot of Vermillion Cliffs..	1,363	"	below (4)	"	"	.0040	"
6. Brink of Permian terrace.	1,022	"	above (5)	"	"	.0030	"
7. Foot of cliff................	568	"	below (6)	"	"	.0016	"
8. Brink of second terrace....	1,022	"	above (7)	"	"	.0030	"
9. Foot of second terrace.....	1,931	"	below (8)	"	"	.0057	"
10. Brink of Grand Canon....	113	"	above (9)	"	"	.0004	"
11. Bed of Colorado...........	1,363	"	below (10)	"	"	.0040	"

These figures are a sufficient proof of the impracticability of making a model of any large section of country without exaggerating the vertical scale, to say nothing of cheaply reproducing it with any degree of accuracy. Our map, constructed with the horizontal scale 5,000 feet to the inch, that is, the same as the vertical, would be about 16 rods long and 9 rods wide. Were it constructed with the vertical scale the same as the horizontal, Mount Whitney would be but .044 of an inch high; Mount Washington, .018 of an inch; and the highest point in Wisconsin, .0053 of an inch. Our model has attached to it one of the summits of the White Mountains, both scales alike, covering a rectangle 9 by 5 inches, and shows in itself just what the effect of exaggeration is. For my part, when I think of a mountain valley represented on the model, I think of it as 65 times wider than it is in the model; and I believe that pupils, if properly taught, will do so. F. H. King.

River Falls, Wis.

A national university.

The issue of *Science* for Dec. 11, 1885, contains an article on 'A national university,' with such reference to my connection with the action of the National educational association on this subject, some years ago, as may be thought to demand my attention.

In so far as the article in question deals with the National educational association and its committee on a national university, it is almost wholly devoid of truth, as I proceed to show, with such fulness as a reasonable allotment of space will allow.

1. How does the author of that article know "there is no evidence that the committee ever did any active work"? The assertion is a bold one, untempered by any qualification whatever. And yet the chairman of that committee, having first sought to bring the originator of this and other misrepresentations before the bar of the national association, at Detroit, in 1874, that he might then and there be openly confuted, himself appeared with proof that a large amount of work, in conference, by correspondence, and by the repeated printing and circulation of successive draughts of a bill, had been done by it, all through a period of years.

2. There is equal falsity in the statement that "Dr. Hoyt, although chairman of the committee of the national association, had never been able to get that committee together, and it [the bill] was therefore essentially a bill presented by a private citizen." Probably there never was a meeting of any committee, composed, as this was, of members from each and every state in the union, at which every member was present; but to say, on this account, that a committee, many of whose members had repeatedly conferred with each other on the subject assigned them, never had a meeting, would be a use of terms of which no reasonable person would approve. As a matter of fact, the members of the committee who attended the sessions of the association during the years in question conferred with each other; while all of the members were repeatedly communicated with, and had a voice in the matter under consideration, as truly as though every one had been present at the meetings. Moreover, every report of the committee so agreed upon by conference and correspondence, and presented to the association, was adopted by that great body without one dissenting voice. And, as for the bill at length presented to congress, it was as truly matured by the committee as any bill was ever matured by any committee; for the three successive tentative draughts of it, each embodying some new amendment or amendments, generally concurred in, were severally sent to every member of the committee, for renewed consideration. More than this, copies of the bill, as amended from time to time, were also sent to a large number of other learned gentlemen and statesmen throughout the land, for their criticism and suggestions.

While, therefore, the bill was drawn by the chair-

man (after years of careful study of university education, and a critical inspection of every important university in the world) and received but few modifications, as the result of its successive rounds, it was prepared by authority of the national association, and also embodied the consensus of a still larger number of persons deeply interested in the effort thus made to advance the interests of university education in America. In a word, it was a bill authorized and practically approved by the national association, and no amount of pettifogging can efface the record of the almost unprecedented unanimity with which it was so authorized and approved.

3. Again: nothing could be more astonishingly false than the statement that "neither bill [the one under consideration and another one presented during the same session of congress] was supported by anybody in any way." For the records of the house of representatives will show that the bill matured by the national university committee was not only fully considered by the committee on education and labor of that honorable body, but was at length reported in a strong and able manner with the unanimous recommendation that it pass, as will appear from the concluding passage of the report as published by the house: —

"If, then, it be true, as the committee have briefly endeavored to show, that our country is at present wanting in the facilities for the highest culture in many departments of learning; and if it be true that a central university, besides meeting this demand, would quicken, strengthen, and systematize the schools of the country from the lowest to the highest; that it would increase the amount and the love of pure learning, now too little appreciated by our people, and so improve the intellectual and social status of the nation; that it would tend to homogeneity of sentiment, and thus strengthen the unity and patriotism of the people; that by gathering at its seat distinguished *savants*, not only of our own but other lands, it would eventually make of our national capital the intellectual centre of the world, and so help the United States of America to rank first and highest among the enlightened nations of the earth, — then is it most manifestly the duty of congress to establish and amply endow such a university at the earliest possible day.

"The committee therefore affirm their approval of the bill, and recommend its passage by the house."

4. Last of all, I call attention to the sublime self-complacency with which, in the face of all his superficiality of inquiry and flippancy of statement, the writer under notice deals with the able and learned secretary of the interior and with the merits of the national university question; telling us gravely, as a final settlement of the whole matter, that, "by all the would-be benefactors of American education, many of the difficulties in the way of establishing a national university have been overlooked." And this the dictum of a writer who, in a discussion involving matters of personal justice as well as of public interest, has been content to rely on *ex-parte* testimony, — this his *ex-cathedra* condemnation of a proposition first made by Washington, afterwards supported by a number of his most distinguished successors in the presidential office, and still more recently approved by such statesmen as Sumner, Howe, Schurz, Hoar, Ingalls, and Lamar; by such men of science as Agassiz, Peirce, Shaler, Henry, and Baird; by the heads of nearly all the universities of the United States; and by the largest association of educators in the world.

After this extraordinary manifestation, it does not seem worth while to descant upon our critic's notions concerning the evils of 'free education' and of what he is pleased to call 'the paternal government.' The demonstration of their unsoundness has been so often made, in the past, by educators who are indeed leaders, that it need not be repeated, unless there should at length appear some real 'leader of education' bold enough to express like 'un-American principles.' Up to this time, so far as I know, but one man in the United States, especially entitled by his position to be heard on the subject of a national university, has declared against the measure. Nor is it easy to see why any liberal-minded friend of American education should oppose the general proposition to found and amply endow one great institution for post graduate work, planted in the midst of the many important scientific establishments, as well as libraries, provided by the government, and so planned as to sustain helpful relations to all the universities, colleges, and common schools of the country. JOHN W. HOYT.

Cheyenne, W. T., Jan. 11.

Temperature of the moon.

My first communication on the temperature of the moon was regarded as supplementary and confirmatory, and not controversial; my second one, as a correction of an erroneous view of my position too hastily formed. Something further here seems necessary with regard to my 'hypothetical moon,' 'an absolutely airless body' with 'equal relative radiating and absorbing powers,' and the 'endless list of limitations.' Unfortunately this is a subject, in whatever way we look at it, in which hypotheses not altogether certain have to be adopted, and in which we have to be satisfied with approximate results, subject to limitations. But my hypothetical moon is very much like the real moon as it has come to me from physicists and astronomers. More than a quarter of a century ago, Stewart established the equality of the radiating and absorbing powers for each kind of heat-ray, and so, of course, for all collectively. But this was from experiments in which there was not much difference between the temperature of the absorbing body and the body from which the heat was radiated; and this law has been extended, without sufficient warrant, to all cases, however great this difference of temperature. Professor Tait, less than two years since ('Heat,' 1884), in giving the usual definition of the equality of radiating and absorbing powers, adds the conditions of a dark body and of equality of temperatures, but immediately after adds, "We assume, with probability, that these latter conditions are not necessary."

In my paper on the 'Temperature of the atmosphere and the earth's surface' (Professional paper of the signal-service, No. 13), I thought it best to make a distinction between the heat received from the sun and that from terrestrial bodies of ordinary temperature. This was suggested by experiments made by De la Provostage and Desains, from which it appeared that polished metals reflected more, and consequently absorbed less, of the heat received from the sun, than from a Locatelli lamp. Accordingly, throughout that paper, a is used to represent the absorbing power of a body for heat from terrestrial

bodies of ordinary temperatures, and a_2 for that from the sun; and this distinction is made throughout, in all the numerous equations into which the radiated heat of the sun enters.

The necessity for this, which at the time was considered only highly probable, is now fully shown by Mr. Langley's recent very interesting and important experiments on invisible heat spectra (*Amer. journ. sc.*, January, 1886). It requires a glance only at the graphic representation of his results (plate iii.) to see that when the temperatures of the bodies differ, the absorbing power of the body of lower temperature, for the heat of a body of higher temperature, is greater than the radiating power at the end of the spectrum of short wave-lengths, and the reverse at the other end. Hence, where there is selective absorption, as there usually is more or less where any part of the heat is reflected, the radiating and absorbing powers of a body, for the heat-rays as a whole, may not be equal. If the reflected heat were considerable, and mostly of the rays of either end of the spectrum, the difference might be considerable. The amount of heat reflected by the moon is probably much less than that radiated, and the white light of the moon does not indicate that there is much, if any, selective reflection. There cannot, therefore, be much difference between the radiating and absorbing power of the moon for the sun's heat-rays taken collectively. The little difference which there may be would, of course, affect my result slightly. If the absorbing power were a little greater than the radiating power, then the temperature of the moon would have to be a little higher to radiate as much heat as it receives and absorbs. It is seen from what precedes that the possible inequality of radiating and absorbing powers has not been overlooked, and was provided for in my paper referred to above, at a time when there was scarcely a suspicion with regard to the general applicability of the law. But its greatest possible effect on my result was considered of too little consequence to refer to in a short communication on a matter in which, at best, we can expect only approximate results. It is true that the equality of the radiating and absorbing powers was one of my conditions, and that the result is strictly true only for this assumed equality, and that this is therefore one of the 'limitations.' But it does not seem that the 'airless body' should be put into the 'endless list;' for I think that astronomers are very nearly, if not quite, unanimous in the opinion that the moon has no atmosphere which can sensibly affect its radiations.

My conditions, strictly, are for mean or stationary temperatures only; but they are applicable without sensible error to the case of the varying distance of the moon, on account of the slowness with which the distance and the corresponding temperature change. With regard to the lunar diurnal variations, the conditions determine nothing more than the limit beyond which the maximum temperature of any part of the moon's disk cannot go; but this is all that has been claimed. If the method is not of general application, or the results deduced extremely accurate, I think they are not to be despised where we, as yet, know scarcely any thing. The laws of Kepler were important in his time, notwithstanding they did not take into account the 'endless list' of perturbations.

I am sorry Mr. Langley has resolved to have nothing more to say on these interesting subjects, for there are many things, somewhat in common with our separate lines of research, which I would like to discuss in a candid and friendly manner.

WM. FERREL.

Washington, Jan. 28.

Professor Newcomb's address before the American society for psychical research.

In your editorial note of Jan. 29, on Professor Newcomb's presidential address to the American society for psychical research, reference is made to his 'very acute observation' that in certain drawings published by the English society as apparent results of thought-transferrence, "the lines join perfectly, as would be the case with the work of a draughtsman who could see, and this too in the drawings made blindfold." You go on to say that 'the natural inference is that there was some trickery;' and you add, that the English society's work 'bears the character of that of amateurs and enthusiasts.' I think you ought, in justice, to let your readers know that the drawings particularly referred to in the address were five in number. Of the series to which three of these belong, it is conspicuously said, in the accompanying report, that, 'as regards the bandage round his eyes,' the draughtsman 'sometimes pulls it down before he begins to draw.' The two other drawings belong to a series which the report says were executed while the draughtsman 'remained blindfolded.' But, if Professor Newcomb will himself try to reproduce these drawings with his eyes closed, he may perhaps be led to agree that their accuracy can hardly be deemed to fall outside the range attainable by the muscular sense alone, especially if aided by a little practice. To brand as dupes and enthusiasts (on the strength of this single 'acute observation') a set of gentlemen as careful as these English investigators have proved to be, seems to me singularly unjust.

WILLIAM JAMES.

Cambridge, Mass., Jan. 30.

Death of Father Gaetano Chierici.

Prehistoric archeology in Italy has just met with a most serious loss in the sudden death, on the 8th of last month, of Father Gaetano Chierici, professor in the college at Reggio, in Emilia, and director of the admirable Museum of antiquities, in that city. In association with Professor Strobel of Parma, and Professor Pigorini, director of the Ethnographic museum, at Rome, he founded, and has continued to edit, the *Bulletino di paletnologia Italiana*, a monthly journal of prehistoric science, now entering upon its twelfth year. Indefatigable in his prehistoric explorations, he is best known for his investigations of the remarkable *Terremares* of Emilia, which have established the existence of the age of bronze in that country. His last work was to superintend the excavation and transport to Reggio of several tombs from a very ancient cemetery discovered at Renedello, near Brescia. This seems to belong to a period of transition from the age of polished stone to a time when weapons of copper were used, anterior to the age of bronze. Chierici believed that they are remains of the ancient, obscure Pelasgic race.

It is proposed to place a simple bust to the memory of this modest and learned ecclesiastic in the museum which he so admirably arranged and illustrated, and of which he deserves to be called the founder. Con-

tributions for this purpose are asked of Italian paleethnologists, and of such foreign friends as may choose to forward their offerings to Professor Pelligrino Strobel, at Parma. HENRY W. HAYNES.

Boston, Feb. 1.

The moon's atmosphere.

I would be glad if James Freeman Clarke would explain the projection of a planet on the moon's face by the refraction of an atmosphere, as implied in his letter to *Science* of Jan. 8. Would not the rays from the planet pass through the atmosphere in a curve, and reach the eye of the observer in a tangent to that curve at the point where it leaves the atmosphere? If so, then, as this tangent would lie without the moon's disk, the planet could not, by refraction, appear projected upon it. W. G. BLISH.

Niles, Mich., Jan. 21.

After reading the question by Mr. Blish in regard to the phenomenon described by me, viz., of the projection of the disk of Jupiter on the face of the moon at the moment of occultation, I addressed notes to Prof. Edward C. Pickering of Harvard observatory, and Prof. B. A. Gould, asking for their opinions in the matter. Both have kindly answered me, and I transmit a portion of their letters for publication. It will be seen that they agree in the main with Mr. Blish, that refraction by a lunar atmosphere can hardly explain the phenomenon.

JAMES FREEMAN CLARKE.

Jamaica Plain, Mass., Feb. 1.

[From Professor Pickering.]

"A homogeneous and quiet lunar atmosphere would pretty certainly not account for the apparent projection of a star or planet on the disk of the moon, although a disturbance in the atmosphere, either of the moon or of the earth, might momentarily confuse the images viewed through it. I should prefer explaining the phenomenon by the physiological effect of irradiation, which increases the apparent size of bright objects, and so might make two disks seem to overlap each other when they were merely tangent."

[From Professor Gould.]

"The phenomenon which you observed, is, I am inclined to believe, by no means an uncommon one, although, as is natural, the published accounts of it relate chiefly to bright fixed stars, rather than to planets.

"I fear that refraction by a hypothetical atmosphere would not explain the phenomenon adequately, although it seems to me that Mr. Blish has overstated his case, and that the ray emerging from the atmosphere would not necessarily be tangent to the curve at the point of emergence. Turning to Herschel's 'Outlines of astronomy,' — a convenient though not altogether trustworthy book, — I find the same phenomenon mentioned in a footnote to art. 414. He speaks of it as an 'optical illusion,' which perhaps it is; but calling it by that name does not explain it. I myself have seen it, and believe that it has been noted by most observers of occultations, and I have seen attempts to explain it by 'irradiation' and by indentations in the moon's limb; but I have never seen any explanation which has appeared to me satisfactory. It belongs to the same class of phenomena as the 'black ligament,' seen when an inferior planet transits the solar disk. This has never, to my knowledge, been satisfactorily explained either."

Festoon clouds of a tornado.

The clouds so termed by your recent correspondent were more strikingly exhibited than I remember ever to have seen them, on the 17th of June, 1882. They formed the under surface of the high advanced sheet overhanging the memorable tornado that destroyed Iowa college and one-third of the town of Grinnell. Other terms referred to by your correspondent more properly describe the appearance, such as sand-bags, droplets, mammillary cloud, or they might be spoken of as innumerable filled pockets hanging from the under surface of the sheet. It was first seen by me in the western sky at 7 P.M., after a bright sultry day. Near 8 P.M. the whole west was filled with heavy clouds transfused with gold. A fierce thunderstorm followed, and passed by. Immediately after this there was a dead calm for a brief time, and then, at 8.45 P.M., the sudden destructive funnel-cloud. It was a local storm, traced a hundred miles, more or less.

Since then I have watched every threatening sky, and have noticed the same phenomenon, less strikingly shown, in at least a dozen instances, alike in local or limited thunder gusts, widely extended storms, and in rainless skies overspread by wild-looking clouds. A splendid exhibition of the last mentioned was seen at sunset last summer. The whole sky was overcast by gilded cloud showing the 'sand-bag' feature, but in larger bags, either absolutely so, or because drifting at a medium cloud-height and overhead. No evidence of rain, nor any unusual surface winds, preceded, attended, or followed on this occasion. H. W. P.

Grinnell, Io.

Death-rates among college graduates.

The recent death of Charles W. Sanborn of New Hampshire is the occasion for calling attention to a remarkable fact.

His death is the first that has occurred in the Dartmouth college class of 1872. Sixty-nine men graduated, and for thirteen and one half years their number has continued unbroken by death. The Chandler scientific class of the same year early lost one man from eleven who graduated.

The deaths in the two preceding and nine succeeding classes to 1872 are recorded as follows: —

Class.	No. graduated.	Deaths since graduation.
1870	50	11
1871	68	9
1873	71	4
1874	68	5
1875	48	1
1876	69	4
1877	54	2
1878	74	3
1879	46	3
1880	48*	1
1881	49	3

* One died just before commencement, and received degree *post obit.*, but is not included here.

EDWIN J. BARTLETT.

Jan. 28.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 5, 1886.

FISH AND FAMINE IN INDIA.

FAMINE seems to threaten with destruction the people of no part of the world so often as that of India; and the query has often arisen in the mind of the writer why the fish-food of that great empire was not utilized in its prevention to a greater extent. The vast peninsula of Hindostan is surrounded by tropical seas; its shores are low, and indented by lagoons; its interior is penetrated by great rivers; its list of edible fishes is an exceedingly long one. It would seem as though more account ought to be made of this food-supply than appears to be the case.

Fishermen have formed a separate caste in India from earliest times. Originally it was subdivided into those who pursued their calling in the open sea, and those who fished inland waters; but now this distinction is lost in most districts. The remains of a patriarchal organization of the caste — in whose history many figures prominent politically may be recalled — still exist, for the fishermen acknowledge several hereditary chiefs, each of whom exercises priestly control over a wide extent of coast, and is a final referee in all caste or family disputes. Subsidiary to them are lesser chiefs over groups of villages, and elective headmen presiding each over a single hamlet. These chiefs decide disputes, are present at marriages and religious ceremonies, often arrange the work of the village, collect government dues, and receive fines and fees, much of which the lower officers must pass on to their superiors.

The general degeneracy of the sea-fishing interest caused the Indian government recently to set on foot an investigation, which was placed in the hands of Dr. Francis Day, who recounted his results in an intelligent paper read before the late fisheries exhibition in London. It appears from this that the key to comparative prosperity or misery among this class of the population is found in the word 'salt.' The only object of getting sea-fish, which go in schools, and may be captured in large quantities at a time (beyond the trifle able to be consumed fresh on the shore), is to preserve them for subsequent use. This can be done by drying, which is an uncertain way, and results in greater or less putridity, or by the use of salt. Salt has not only been made from sea-water by native methods since ancient times, but in certain regions of the coast, as in western Madras, saline earths are found which form an imperfect substitute.

Former British rulers placed a heavy tax not only on the importation and manufacture of good salt, but even taxed the collection of the poor salt-earth: these impositions varied in different districts, and in some have been removed. Surveying the whole seacoast, it is now seen that wherever salt was dear, except in a few places supported by a brisk local demand (as in the vicinity of large cities), the fish-curer's trade was destroyed, and hence the fishermen were greatly depressed, decreasing in numbers, and seeking to become boatmen or sailors; that fish salted with taxed or monopoly salt was simply a luxury for the rich, and valuable as an export, so that the poor had to consume their fish putrid, or save it for a short time by immersing it in sea-water and drying in the sun; and that which is prepared with the salt-earth keeps badly, and predisposes the consumer to disease. The unmistakable result of this tax has been to discourage and lessen, if not wholly to ruin, a large proportion of the food-producing population of the empire. Moreover, it has brought about not only this special harm, but harm to the general public, whose food-supply is thus not only greatly diminished, but is put at an abnormally high price, since all the fishermen have now sunken into the hands of the money-lenders to whose advances of capital they owe their ability to do any thing at all, and to whom the whole catch must be turned over as soon as taken.

The fresh-water fishes differ in many respects from marine ones. Wherever any quantity of fresh water exists in the east, fishes are certain to be found, all the way from sea-level to near the summit of high mountains. In India this is particularly true, and the people fish in rivers, lakes, irrigation canals, tanks, ditches, swamps, and inundated fields; and, as fishing is a less laborious occupation than agriculture, the pursuit is in high favor in those ease-loving latitudes.

In olden times, under native rule, the fisheries were held as royalties, and mostly were let out to contractors, who retained the sole right to sell fish, but issued licenses, on payment, permitting families to catch for their own use. Remains of this custom, in one form or another, still exist. Along the Himalayas, in the Kangra and other districts, the petty rajahs adopted another plan,

selling licenses to supply the markets, and also to catch with small nets for table use. This was the plan in Burmah also, while the erection of weirs was greatly restricted, or, in some regions, prohibited altogether.

Under British rule these regulations have lost force, and notions once distinct as to fishing privileges and rights have become confused. At first fishermen and fishing implements were both taxed, besides the leasing fees of the fishing-grounds. Gradually these were removed, and many fisheries were made free; but this intended boon has proved an evil, as was the case with the sea-fisheries. Now the inland fisheries are open to all. When whole districts were let to contractors, they were not so short-sighted as to permit indiscriminate destruction; but now everybody does as he likes, when he likes, and how he likes. Every device that can be thought of is called into use. As soon as the monsoon has set in, and the fry begin to move, women and children daily search for them in all the sheltered spots to which they retire for rest or hiding. Nets that would not let a mosquito pass, and even solid cloths, are used for raking out the last one of these fingerlings. So soon as fish commence moving up the rivers for the purpose of breeding, so soon begins the work of destruction, aided by every implement of capture which human ingenuity can invent, not even excepting the scooping-up of whole deposits of fresh ova, and the wholesale poisoning of streams. When the few agile survivors have succeeded in running the gauntlet of weirs, traps, wicker baskets, and nets, of every size and shape, these are all reversed, and set in waiting for their return to the sea. The rod-fishing for mahaseer, the principal game-fish of northern India, is utterly ruined in many districts. Even fishes' eggs do not escape the general hunt to which the persecuted finny-tribes are subjected; for these are collected to be made into cakes, which are thought a great delicacy.

The result of all this heedlessness and indiscriminate destruction is already apparent, and is at last exciting the anxious attention of the rulers of India. The professional fishermen of the empire have decreased in numbers, and their villages are declining into deeper and deeper poverty. In the markets fish-food commands a higher rate than naturally belongs to it, and there is prospect of its steady rise. The longer this goes on, the more fish becomes a luxury for the rich, instead of a common resource for the poor, as seems to be its natural level; and it affords to other nations, as well as India, an example of the poor policy of placing no restrictions upon the harvest of sea and river. ERNEST INGERSOLL.

THE MOUSE-PLAGUE OF BRAZIL.

It is well known that the fauna of America, especially that of the higher animals, presents a large number of peculiar types. Not only many of the lesser groups, but sometimes whole families of cosmopolitan orders, such as apes, opossums, etc., we find distinctly separated from those of the old world by some general peculiarity. The indigenous mice of America differ from those of the eastern hemisphere in some features of dentition, and also show a considerable variance in their habits.

The larger number of all the native species belong to a single genus, Hesperomys, of which in Brazil a dozen or more are known, differing in size from that of the ordinary mouse to that of the largest rat. They do not invade dwellings except under unusual circumstances, but mostly live in burrows of greater or less extent; some not less than seven or eight feet in length, widened at the end into a large excavation or chamber, which is filled with grass. They are omnivorous in their habits, feeding indifferently upon grass, seeds, and flesh. Their enemies are numerous, the more important of which are various snakes, and especially the tiger-cat and fox. A large dipterous insect, a bot-fly, is also parasitic upon many, the larvae of which are as large as the end of one's finger, and burrow beneath the skin.

Under ordinary circumstances they are not at all abundant, so that at times naturalists can secure specimens of many species only with difficulty. The almost inconceivable increase and abundance during certain years, to such an extent that they become a national calamity, is thus the more remarkable. In the colony of Lourenço one of these remarkable visitations has thus been described.[1] In the months of May and June, 1876, they suddenly appeared in enormous numbers. They invaded the maize-fields in such great numbers that the corn seemed literally alive with them, destroying in a few days every thing that was edible; and where, but a short time before, bushels of grain might have been harvested, not an ear remained, and the noise produced by their nibbling and climbing was audible for a considerable distance. After the corn-fields were devastated, the potatoes next received their attention. Only the largest were eaten in the ground: such as were transportable were carried away, and hidden in hollow trees or other retreats for future use. Gourds and pumpkins, even the hardest, were gnawed through and eaten. Of green food, such as clover, oats, barley, not a leaf was left standing:

[1] Zur kenntniss der brasilianischen mäuse und mäuseplagen. Dr. H. von Ihring, *Kosmos*, December, 1885.

even weeds were cut down, and the inner parts eaten out.

In the houses the struggle for existence of these long-tailed invaders was truly amazing. In many of the dwellings hundreds were killed in a single day. The cats could contribute but little aid, fighting such a plague; for not only were many of the rats so large that it would have been an unequal contest, but by their great number they drove the cats actually from the houses, not to return until the plague was passed. Nothing, except what was composed of iron, stone, or glass, was spared from their destructiveness: furniture, clothes, hats, boots, books, — every thing bore the traces of their teeth. They gnawed the hoofs of cows and horses in the stables, literally ate up fatted hogs, and often bit away the hair of persons during sleep. They penetrated all apartments, and gnawed their way through boards and walls of houses. Ditches that were dug about granaries did not suffice: the mice would climb over each other in some corner or other, and thus reach the top.

The foregoing account of one occurrence in Lourenço will suffice to show to what an extent the plague reaches. The same province had suffered similarly in 1843 and 1863, and in all probability will again in 1889. Our astonishment at the strange appearance and disappearance of such swarms of animal life is greatly increased when we perceive in what a close relation of cause and effect it stands with the presence or absence of food-supply; and probably nowhere among the vertebrate animals is the relation more apparent than here.

This food-supply is derived from the seeds of a large bamboo-grass (Taquary or Cresciuma) growing throughout Brazil. This grass grows in dense thickets to the height of thirty or forty feet, and bears a very large quantity of seed. Its natural history is remarkable. At regular intervals, varying in the different species from six to thirty years, it matures and blooms, and then disappears. Yet more remarkable is the uniformity with which it attains maturity throughout an entire province, if not the whole southern part of Brazil.

Similar plagues, though far less in extent, have occurred in Europe, in which the field-mice unaccountably appeared in greatly increased numbers. One may well think what would be the result were these little, almost insignificant creatures everywhere in such wise to take the ascendency. When one considers that on an average of every one or two months from five to eight young are born, and that these young become mature in a few months themselves, he will not be surprised to know that a single pair of the common field-mice, in the course of a single summer, would increase to twenty-three thousand individuals. Could all the conditions which now keep them in check be removed, every living thing upon the earth would be consumed in a half-dozen years.

BEE-HIVES AND BEE-HABITS.

One of the substantial improvements in bee-hives made in the last few years is the arrangement whereby the frames holding the combs can be quickly and easily turned up side down. The best arrangement of the several tried is where the rectangular frame holding the comb revolves on pivots fastened at the central point of the end-bars, within a half-frame just enough larger to permit the full frame to turn. The half-frame has the projecting top-bar of the usual Langstroth frame, and the half end-bars receive the pivots of the inner frame at their lower ends. Two years' experience shows me that these frames are a success.

But why this inversion of frames and combs in the hives? As is well known, bees only attach their combs firmly at top and upper portions of the lateral edges. It is probable that in past ages our honey-bees attached their combs to limbs of trees, as Apis dorsata does to-day, and as our honey-bees do in exceptional cases: hence the strong instinct to attach firmly above, slightly at the sides, and not at all below. By inverting the frames we take advantage of this habit, and secure firm attachment on all sides, thus making the combs secure for shipping, and less apt to break out when we are extracting or manipulating them for any purpose.

Another invariable habit with bees is to place their brood below the honey in the combs. Thus we always find honey at the top of the comb, and the brood at the bottom. Every bee-keeper is also aware that it is not always easy to induce the bees to leave the brood-chamber below, and pass to the sections above, when we desire to secure the comb-honey. But it is found, that if we invert our frames just as the honey harvest commences, thus throwing the honey below the brood, the bees at once, true to their instinct, pass into the sections, as they wish honey above their brood; and so we not only get the freshly gathered stores, but the honey previously stored in the brood-chamber carried into the sections above, just where we desire it, and all space below vacated for the brood, which is also desirable.

Not only is it desirable to invert the brood-frames, but the sections as well. This secures more firm attachment of the combs in the sec-

tions, and hastens the filling and capping, which is always more quickly and speedily done at the top than at the bottom. It is more than likely that the future hive will be so constructed that the entire hive, as well as the crate holding the sections, can be inverted at pleasure. This will give all the advantages named above with the least possible expense of time. The changing of the comb does no injury in any way, and is thought, by those who have tried it most, to prevent swarming. Turning the combs over causes the bees to tear down the queen-cells.

The late Mr. Samuel Wagoner suggested that the laying of fecundated eggs (those which develop into females) or unfecundated (those which produce drones) was automatic, and not an act of volition. The small worker-cells, he said, would compress the queen's abdomen, and thus force the sperm-cells from the spermatheca, and the eggs would be impregnated. The larger drone-cells would fail to exert this necessary compression, and so the eggs would pass unfecundated.

Bee-keepers now generally think that the queen is no such machine. Why the muscular apparatus connected with the spermatheca, except that it is to be used voluntarily to extrude the spermatozoa as the queen may desire? Sometimes worker-cells just started receive eggs which always develop into worker or female bees. Here the cells could not compress the queen's abdomen. The queen also lays fecundated eggs in the queen-cells, which are larger even than the cells which receive the unfecundated eggs, — the so-called drone-cells. That this act of adding or withholding the sperm-cells from the eggs is an act of volition on the part of the queen, is further proved in the fact that young queens, just beginning to lay, often scatter drone-eggs here and there in worker or the small cells. These, of course, produce drones, which only vary from the usual drones in their smaller size, which is necessitated by the smaller cells. This is obviously a mistake, and seldom occurs after the first two or three days of the queen's life. Now, may we not consider this the result of inexperience, the mistake of a novice? The queen has never yet used the complex muscular apparatus of the spermatheca, and at first fails in her attempt to work it satisfactorily. Soon she gains by experience, and makes no more failures. To assert this is no more irrational than to say that a colt will stumble and fall when it first begins to walk.

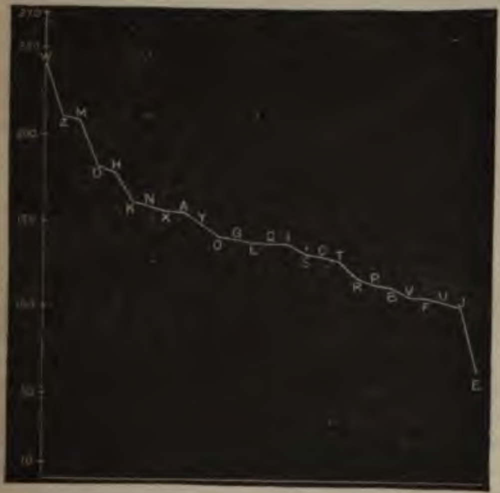
The observations of Sir John Lubbock and others as to wasps bear directly on this question. He finds that the mother-wasp invariably stocks the cell where the unimpregnated egg — the one that is to produce the male, which is considerably smaller than the female — is deposited with a less number of insects than the one where the impregnated egg which is to develop into a female is placed. Here we see that the mother-wasp not only knows the kind of an egg she is to lay, but she provisions the cells with exact reference to the necessities of the case. As the wasp puts just so many insects in each cell, it is evident that she has learned to count. Who shall be so prejudiced as to say that her waspship does not consider her act in laying the special egg, and does not think and plan her maternal acts looking to the larders of her yet unborn? We all know how close the relationship between wasps and bees is. Now, if a wasp realizes what she is doing as she adds or withholds the sperm-cells, to such an extent that it influences her daily acts, and modifies her performance of daily duties, who shall say that the queen-bee, of higher development and structure, does not think upon her acts as she places the eggs in worker or drone cells? Here, then, is another proof that egg-laying with the queen is a matter of intelligent volition; and far be it from me to say that the queen does not consider the size of her home, the size of her family, and the condition of her larder, as she passes in stately mein over the combs, stocking the worker or drone cells as circumstances dictate. If such volition and discretion are exercised, it makes plain many peculiarities noticed in studying bees. It makes it easy to understand why there is so much variation as to the swarming-habit, drone-production, etc., of different colonies of bees. Each queen has her own notions.

A. J. COOK.

LEGIBILITY OF LETTERS OF THE ALPHABET.

MR. JAMES CATTELL has recently published in *Mind* the results of studies upon brain and eye inertia, of which the following will be found of interest. Some alphabets are harder to see than others, and the different letters of the same alphabet are not equally legible. Reading is one of the largest factors in our modern life, but at the same time a thoroughly artificial act. Here, as everywhere in nature, the organism shows its power of accommodating itself to its environment; but the large percentage of children who become shortsighted and weak-eyed, and suffer from headaches, gives us sharp warning, and puts us on our guard, lest these diseases become hereditary. Considering the immense tension put, of necessity, upon eye and brain, it is of the most vital

importance to relieve them by using the printed symbols which can be read with the least effort and strain. Experiments are not necessary to show that books (especially school-books) should be printed in large, clear type; but experiments may lead us to determine the most favorable type. It seems probable that the use of two varieties of letters, capital and small, is more of a hurt than help to the eye and brain. All ornaments on the letters hinder: consequently the German type is injurious. The simplest geometrical forms seem the easiest to see. The lines must not be too thin. We seem to judge the letters from the thick lines, and it is doubtful whether it is advantageous to use thin and thick lines in printing. From all these considerations, it seems that our printing-press has not improved on the alphabet used by the Romans. "Our punctuation-marks are hard to see, and, I think,



quite useless. It seems to me far better to replace (or, at all events, supplement) them by spaces between the words, corresponding in length to the pauses in the thought, or, what is the same thing, to the pauses which should be made in reading the passage aloud. Such a method of indicating to the eye the pauses in the sense would not only make reading easier, but would teach us to think more clearly.

"As I have already stated, not only are some types harder to see than others, but the different letters in the same alphabet are not equally legible." It was found that certain letters were usually correctly read, whereas others were usually misread or not seen at all. Fifty-four series were made with the capital Latin letters: consequently each letter was used 270 times. Out of this number of trials, *W* was seen 241 times, *E* only 63 times. The relative legibility of the different letters is clearly shown in the figure, in which the ordinates are taken proportional to the number of times each letter was read correctly out of the 270 trials.

Certain letters, as *S* and *C*, are hard to recognize in themselves; others are mistaken for letters similar in form, as in the case of *O*, *Q*, *G*, and *C*. The great disadvantage of having in our alphabet letters needlessly difficult to see will be evident to every one. "If I should give the probable time wasted each day through a single letter, as *E*, being needlessly illegible, it would seem almost incredible; and, if we could calculate the necessary strain put upon eye and brain, it would be still more appalling." Now that we know which letters are the most illegible, it is to be hoped that some attempt will be made to modify them. Our entire alphabet and orthography need recasting: we have several altogether useless letters (*C*, *Q*, and *X*), and there are numerous sounds for which no letters exist. In modifying the present letters, or introducing new forms, simplicity and distinctness must be sought after, and experiments such as these will be the best test.

"Experiments made on the small letters show a similar difference in their legibility. Out of a hundred trials, *d* was read correctly 87 times, *s* only 28 times. The order of distinctness for the small letters is as follows; *d, k, m, q, h, b, p, w, u, l, j, t, v, z, r, o, f, n, a, x, y, e, i, g, c, s.* As in the case of the capital letters, some letters are hard to see (especially *s*, *g*, *c*, and *x*) owing to their form; others are misread, because there are certain pairs and groups in which the letters are similar. A group of this sort is made up of the slim letters *i, j, l, f, t*, which are constantly mistaken the one for the other. It would not perhaps be impossible to put λ in the place of *l*, and the dot should be left away from *i* (as in Greek). It seems absurd, that, in printing, ink and lead should be used to wear out the eye and brain. I have made similar determinations for the capital and small German letters, but these should be given up. Scientific works are now generally printed in the Latin type, and it is to be hoped that it will soon be adopted altogether. At present, however, it is impossible to get the books most read (Goethe, for example) in Latin type."

BLONDES AND BRUNETTES IN GERMANY.

WITHIN the last few years the German government has authorized a commission, at the head of which is Professor Virchow, to collect statistics in

the interests of anthropology on the relative proportions and geographical distribution of blondes and brunettes in the German empire. Before the Anthropological congress at Carlsruhe, Professor Virchow gave an account of the results of these observations, illustrating his remarks by diagrams. An account of the study, together with the illustrations, will appear in full in Germany.

The study included all children of school age throughout Germany. Those only were classed as blondes who had light hair, blue eyes, and a fair complexion. The brunettes included those who had black hair and eyes, though the complexion might be more or less fair. All others were classed as mixed, including those with gray eyes. It is to be regretted that the same method was not followed in Belgium, where similar studies had been in progress, so that a direct comparison could be made.

Thirty-two per cent, or almost a third of the German youth, are blondes; 14 per cent are brunettes; while all the rest, 54 per cent, must be classed as mixed. This mixture is not a homogeneous one, but includes all intermediate varieties. One class of the German population forms a decided exception to these averages, viz., the Jews. Jewish children show only 11 per cent of blondes, but 42 per cent of brunettes. Their greater purity of race is shown by the small ratio of the mixed class amongst them. The blond type is particularly prevalent in Oldenburg and the neighboring more northerly communities: it is rarest in eastern Bavaria and in Alsace. A canton (Wildeshausen) in Oldenburg has 56 per cent of its population blondes, while Roding, a town in the second group, has only 9 per cent, a difference of 47 per cent. The former has only 4 brunettes to each 100 inhabitants, while a southern town in Alsace has as many as 31 to 100. The distribution of the blond type is much wider than that of the brunette type, which is only a secondary type. A canton in Wurtemberg shows the largest ratio of the mixed class, 60 per cent, while Pomerania shows the smallest, 40 per cent. The same contrast between the north and the south is shown in Belgium and in Switzerland. In southern Austria the brunette type is especially marked, but here the mixture with the Slavic people adds a complication.

What is the origin of this dark race amongst the Germans? Ancient writers describe them as having fair hair and eyes. One can assume that the immigrating races were of two types,—blondes and brunettes. But this would not account for the present geographical distribution, or perhaps a gradual transformation has taken place: this is improbable, because the climatic and other differences between north and south Germany are not sufficient to bring about such marked differences. The true explanation is suggested by the large proportion of the mixed class. The Germans were blondes, and spread to the east and south as such; but in Switzerland and Alsace they encountered a dark race, which was not expelled, but forced a mixture with the conquering race. The gray eyes are an indication of this great mixture of types, and not a mark of a third type. The questions regarding the brunette type must be resolved into a series of secondary problems connected with the general development of all the types. It must also be remembered that the characteristics by which the Germans have been described are not peculiar to them, but are common to other anthropologically different nations, of which the Finns are an example. Professor Virchow expressed the opinion that a comparative study of this question in different European nations would be of great importance.

DEFORMITIES OF BONES AMONG THE ANCIENT PERUVIANS.

NEARLY fifty years ago Dr. v. Tschudi, in the disinterment of a number of Indian graves in the vicinity of Lima, found one containing the parts of three skeletons, in which the bones showed peculiar deformities, due to disease. The graves were near the famed temple of Pachacamac; and from the position, as well as the associated objects, Tschudi determined them to belong to one of the earlier epochs of the Incas, in the thirteenth century of the Christian era. From the accounts given by the native Indians, Tschudi learned of other graves, farther south, in which numerous skeletons with similar deformities had been found, and from which he concluded that persons thus afflicted had been buried together, as has been more recently done with the bodies of those dying from cholera.

These specimens were studied a few years later by Zschokke, who found the deformations so different from those produced by other known causes, that he pronounced the disease a new one. Very recently, however, the bones have come under the examination of Professor Virchow,[1] who has determined the cause to have been the affection described under the name of 'multiple exostosis.' This disease is one of the rarest known, and has only been recently studied and described. It is due to abnormal development, and appears most frequently near the ends of the long bones, resulting in remarkable growths, sometimes as

[1] Ueber krankhaft veränderte knochen alter Peruaner, von Rud. Virchow, *Sitzungberichte d. k. preussischen akad. d. wissenschaften*, 1885, p. 1129.

spongy masses, at other times as long, firm, ivory processes of the most varied shapes, several inches or more in length. The disease is more or less hereditary, nevertheless its apparent frequency among the ancient Incas is interesting.

Of more especial interest, however, is the relation which Virchow surmises to exist between this multiple exostosis and the bony growths found with remarkable frequency in the ear-canals of the ancient Peruvian crania. Nearly two scores of specimens have been described, in which either one or both auditory canals were more or less filled with bony growths, usually near the middle. As in nearly all these cases the peculiar flattening or elongation of the occipital region occurs to a greater or less extent, some have assigned this as the cause. Others have thought that the custom, so common among the Incas and other non-civilized races, of wearing rings or large disks of metal in the fleshy ear, had produced the affection. To both of these views Virchow objects. Not only have cases been observed among the North American Indians where there is no cranial deformation, but in the Incas themselves deformed skulls without, and undeformed skulls with, the exostosis, are known. The very common custom among many races of the present day, of wearing foreign substances in the ears, is not known to produce this result. The author believes them to be due to abnormal ossification, of a nature either closely related to, or identical with, that in other parts of the skeleton. Why this disease should have occurred with such greater frequency among this race we do not know, and we can only speculate upon the extent that it affected the audition. The effects of the disease must have been produced in childhood, probably early. In many cases the auditory canal is entirely closed on one or both sides, in others much narrowed. That it must have diminished the power of hearing, is evident. To what extent absolute deafness was caused, one cannot say.

LARGE VERSUS *SMALL TELESCOPES.*

THE critical observer can hardly fail to have noticed, during the past few years, the setting-in of a slight reaction against the monster telescopes and their capacity for advanced astronomical work. Perhaps this is not better defined at present than a tendency to reaction merely; and it seems to have had its origin mainly with a few possessors of medium-sized instruments, who, perhaps, had failed in their efforts to procure larger ones. Any astronomer who has had experience in the adaptation of different kinds of observational work to the varying capacity of different instruments knows very well that there is work enough of a sort which the largest telescopes only are fitted to perform in the best manner; and he also recognizes the fact that in other times of research, which are happily by no means exhausted, the small telescopes have many advantages over the large ones. But these relate rather to the mechanical than to the optical parts of the telescope.

It is not too much to say that the methods peculiar to the opticians of the present day have advanced the construction of the telescope to a degree of perfection which far surpasses the apparent possibilities of observational astronomy in other directions. If the optician gives the astronomer a practically perfect instrument, and the latter finds its performance disappointing, one or other of three things will be true: either he has set it up in a bad atmosphere, or the work to which he has put the instrument is ill adapted to its size, or (it is a good thing for every ambitious fledgling to institute this modest though often disastrous inquiry) the trouble resides in the cerebro-optical apparatus just outside the eye-piece. The first of these conditions appears in a fair way to be partially removed in the early future by the building of mountain observatories in regions where great steadiness of the upper atmosphere is insured; the second gradually removes itself with every new experience; while the third constitutes a very serious obstacle to the progress of the sciences; for what can the conscientious astronomer do with the work of a bad observer? He hesitates to mingle bad observations with good ones, for he cannot tell how much the accuracy of the final result may be impaired; nor does he like to reject the bad ones, because his work is then open to the charge of incompleteness; and, besides, the bad observer makes it an invariable rule to omit all data which might help the theoretical astronomer to find out just how bad his observations are.

Until lately, those who have been discussing in astronomical journals the relative merits of large and of small telescopes have quite overlooked the astonishing variation in the eye-power of different observers. As a general rule, — and for a very obvious reason, — the large telescopes come into the possession of the best observers, while the weaker eyes and heads must continue their use of the smaller instruments. Notwithstanding this natural result of evolution, the lesser telescope sometimes seems to have the greater advantage. While fully realizing the superior power of the great telescope, the observer using it has learned to be very cautious in pronouncing upon what he sees: but the imaginative amateur is bound by no such restrictions; he is free to conceive what

ought to be there, points to his spy-glass, and, lo! there it is. If, then, a trained observer with a larger telescope fails to verify his marvel, what better proof is needed that the great telescope is ineffective? It is an axiom in astronomy, that, when once a discovery is made with a large telescope, the object can always be seen with a smaller one. This presumes, of course, that the same observer uses the two instruments, and that he knows where to look and what to look for with the smaller one. And this in no wise constitutes an argument for equality of the small telescope with the larger; for with a good atmosphere, and the superior telescopes now made, it is never true that the nature of any celestial object can be made out with a small telescope which a larger one will fail to show more satisfactorily. Taken in connection with the attempts of late years, so far successful, to set up powerful telescopes on mountain elevations where a correspondingly perfect atmosphere is obtained, the future of the monster telescope is most hopeful. D. P. T.

MAKING A NEW MERV OASIS.

THE Russians have fixed their minds, says *Engineering*, on a new enterprise, well calculated to set on edge the teeth of English and Indian statesmen. This is no other than the formation of a new oasis, as large as that of Merv, along the new frontier to the Oxus, which the Afghan delimitation commission will delineate as soon as the spring weather enables it to quit its winter quarters at Tchamshambe. Briefly, the scheme, which is said to be a sober engineering design, complete in all details, and drawn up on the spot by the surveyors of General Annenkoff, the constructor of the Transcaspian railway, provides for cutting the bank of the Oxus near Tchardjni, and allowing the water to flow afresh through some ancient channels running in the direction of Merv.

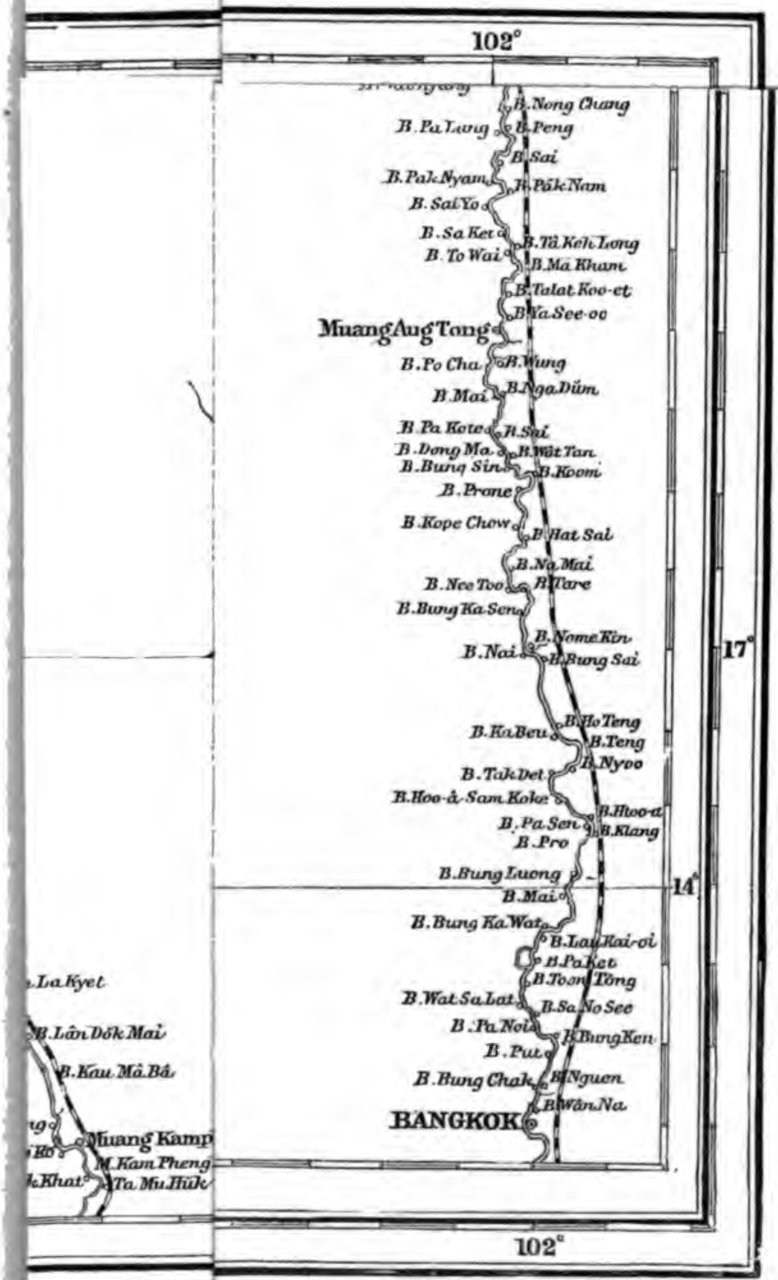
There is no particular novelty in the idea, the oasis of Khiva being formed entirely of country irrigated by an elaborate system of canals running out from the Oxus near its entrance into the Aral Sea, while the Merv oasis is of a similar character, and uses up all the water of the Murghab. The channels, we have said, already run into the desert near Tchardjni; and a careful series of levels, taken during the autumn, show, that if the bank of the river be cut, and the channels cleared of drift in one or two places, the water will run freely for sixty or seventy miles. The nomads can then be left to manage the rest of the business themselves; for the natives of Merv and Khiva are extremely clever in making irrigation canals, and they would speedily establish a network, and convert the clayey expanse now devoid of vegetation into a green oasis, as fertile as any in central Asia.

Readers of O'Donovan's and Marvin's books on Merv will not have forgotten, that as far as the Turcomans convey water from the Murghab, there amazing productiveness prevails, although immediately beyond is a desert. All that is really needed, therefore, is to withdraw from the Oxus a sufficient quantity of water (and Annenkoff's calculations show that abundance can be spared), and a year would be sufficient to create an oasis capable of supporting a quarter of a million people. In that case Russia could march troops from Askabad and Merv to the farthest parts of Turkestan, and despatch the Tashkent and Samarcand forces through Bokhara to Merv and Sarakhs in return, without having any desert to traverse, and the communications along the new frontier would be perfect. As the cost would be only £160,000, no doubt whatever is entertained in Russia that Annenkoff's proposal will be accepted.

DR. ARISTIDES BREZINA of Vienna has published a catalogue of the fine collection of meteorites in the Hofkabinet. The richest collections of meteorites are those of the museums of London, Vienna, Paris, and Calcutta. On May 1, 1885, the Vienna collection contained representations of 358 genuine falls. Dr. Brezina accompanies his catalogue by a valuable essay on the origin and classification of meteorites, and by a map of the world showing the localities in which the Vienna specimens have been found.

— The *Revue sud-américaine* of Dec. 30 announces the organization of a new scientific society in Paris under the name, 'Académie de l'Amérique latine.' The academy will be divided into four sections, as follows: social and political; historical and literary; geographical and ethnographical; economical, commercial, and financial. It will be devoted solely to the Latin nations of America, and the membership will be unlimited. It will publish a bulletin in the French, Spanish, and Portuguese languages.

— Extended researches by F. Emich (*Centralblatt für agrik. chemie*) show that the purification of natural waters is effected almost wholly by organic agencies; the chemical action of ozone, peroxide of hydrogen, and the oxidation from the air, exerting but a feeble influence. This was proved by experiments made upon water in which the germs had been destroyed by boiling.



SCIENCE, February 12, 1886.

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SCIENCE.

FRIDAY, FEBRUARY 12, 1886.

COMMENT AND CRITICISM.

THE CALIFORNIA TROUT (Salmo iridea), which inhabits a restricted geographical range on the west coast, has been extensively introduced into the streams of the eastern and middle states through the agency of the U. S. fish commission. In the spring of 1880, ten thousand eggs of this species were allotted to the Missouri fish commission. These were hatched out at the state hatchery, and the fry planted in the head waters of the Gasconade, Osage, and other streams of south-west Missouri having their sources in the clear, cold, large, flowing springs that abound in the Ozark Hills. Three thousand were planted in the head waters of Spring River, a tributary of the Arkansas. A careful inspection of the stream, made in the summer of 1885, by the commissioner of fisheries for Missouri, and others, who were familiar with the rainbow trout, showed the presence of at least three generations resulting from the original plant. The largest in size weighed between four and five pounds; those of the second size measured from fifteen to seventeen inches in length; while the immediate sources of the stream swarmed with thousands of the young trout from four to five inches in length. Accepting the indications of success thus afforded, the U. S. commissioner of fisheries is now maturing plans on an extensive scale for introducing the rainbow trout into the head waters of all the streams of Missouri, Arkansas, and the Indian Territory, which have their sources in the Ozark Hills. The area to be colonized is more extensive than the famed Adirondack region of New York, which is now the paradise of sportsmen. The streams are clear and cold, the temperature of the waters not rising above 58° F. in the heat of summer. They have every characteristic of good trout-streams, and experiment has shown their eminent adaptation to this purpose. We wonder that nature has neglected so inviting a field, yet we are informed by the state commissioner of Missouri that no native species of trout is found in any of the streams that rise in the Ozark range. The explanation will probably be found when we know accurately the history of the development of the surface features of the interior of the continent during the post-pliocene. Be this as it may, it seems to have devolved upon the U. S. commission to enter upon and utilize nature's neglected opportunities.

LIEUTENANT DYER of the U. S. hydrographic office has compiled from the 'Monthly pilot charts' a hundred or more accounts by sailors of the use of oil to lessen the dangerous effects of the 'combing' of heavy seas during gales of wind. The hydrographic office has so far only aimed to record the experiences of mariners as reported at that office, and has not taken any decided ground as to the merits of the controversy. The mass of evidence collected is sufficient, however, to warrant the careful testing of this claim of the efficacy of oil in stilling troubled waters, and the government should at an early day detail some officer, and supply him with a vessel, that proper experiments may be made. So far as the sailors' yarns go, it appears that mineral oils are not so effective as vegetable or animal oils; and it is interesting to note that their evidence has led some of the insurance companies and steamship lines to insist upon the use of oil when occasion should require.

RELIGION IN COLLEGES is a subject at present attracting considerable interest from the attitude which Harvard has assumed regarding it. In an animated discussion between Presidents Eliot and McCosh, at the last meeting of the Nineteenth century club, the former took the view that the unsectarian college was the most useful, but by no means the only useful kind in a country with no established church and no dominant sect; while Dr. McCosh argued in favor of the retention of religion in colleges on account of both public and individual benefit. Against the sectarian institutions, said President Eliot, objection is urged first on the ground that they perpetuate class distinctions, that they foster intolerance and narrow-mindedness, and that they do not inculcate strength of character. These objections will, of course, apply strongly only to the positive class, where of all the teachers and students is required a rigid conformance with the

religious observances. The far larger number of institutions, however, occupy a position intermediate between this positive, thorough-going denominationalism and unsectarianism; and the objection brought against such is that their position is doubtful and uncertain, and their ambiguity a positive evil. The advantage of the unsectarian school, such as Harvard, is that its position is unmistakable, and a voluntary activity in religious matters is stimulated, while no attack is made on the student's faith. The officers and teachers are appointed without reference to denomination, and students are free to go to church or not. It has the disadvantage of not possessing the entire support of any denomination, and hence suffers a loss of power. It appears to be indifferent to religion, though in reality it is not. On the other hand, Dr. McCosh argued that morality could not be taught effectively in an institution without the aid of religion; that when religion is not honored in a college, agnosticism will prevail among the students; that religion gives higher aims and nobler ambitions, while its absence destroys zeal and activity. He also held that the period of college life was that in which moral and religious guidance was most needed. He knew that it was possible to retain a lively interest in religion without sacrifice of tolerance and religious freedom.

THE EXTENSION OF COPYRIGHT.

THE eighth clause of the eighth section of the constitution of the United States grants to congress the power "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." The effort now making to revise the copyright law looks to an enlargement of the operation of this clause. Heretofore, by 'authors' the law has meant only 'citizens of the United States, or residents therein.' It is now proposed in effect to strike out this limitation, and give 'exclusive right' 'for limited times' to all authors who may comply with the conditions of the statute pertaining to copyright.

At a recent hearing before the senate committee on patents, I offered what seemed to me the simplest, most direct, and most reasonable practical solution of the problems involved in international copyright, and a careful consideration of all the plans proposed has only confirmed my confidence in the method which I outlined. This method supposes the present law, now applicable to citizens of the United States only, to be extended to any alien who will accept the conditions under which an American author lives. The American author must enter the title of his book in the office of the librarian of congress; he must publish his book in this country, recording upon every copy the fact that he has taken out copyright; and within ten days of publication he must deposit two copies of his book in the library of congress. Then only is his title in his literary property complete.

I would ask nothing more and nothing less of the foreigner. I would require him to record his title, to publish his book here, and to deposit his two copies in the library of congress within ten days of publication, and then I would give him all the protection which the law gives to the American author. No one should be allowed to print his book except his own agent, and no copies from other countries should be allowed to come in to interfere with the edition copyrighted and published here.

Probably none of the advocates of international copyright would seriously object to this method as regards the entry of the title and the deposit of the two copies. There are some, however, who claim that the foreigner shall not have imposed upon him the condition which rests upon the native author, of publication in this country. Why not? It is said that we have been unjust to the foreign author, and that now this injustice is working the greater injury to the American author. It is to repair the wrong that we now propose an amendment of the statute. The only rational reparation is one which will put the two authors on an equality. We ask that the English author shall accept the conditions of the American author in America. We are perfectly willing to concede that the American author shall submit to the conditions of the English author in England.

This solution of the copyright problem is not more based upon theoretical fitness than it is upon practical experience. In the absence of any international legal arrangement, there has grown up of late years, between England and America, an international business arrangement. An American author to-day may secure protection for his book in England by publishing there twenty-four hours earlier than he publishes in this country. An English author may secure a quasi protection for his book on this side by publishing here at the same time as he publishes in his own country. The distinction in the two cases must be noticed. By English custom, fortified, I think, by a decision of a minor court, an American author's book which has appeared in England a day earlier than in the author's coun-

try, is so far protected that no other publisher than the one with whom the author has arranged can bring it out. There is no such law, nor even any such custom, in this country. But so great an advantage has an American publisher over his competitors, when by previous arrangement he is enabled to bring out an American edition of an English book simultaneously with its appearance abroad, that he rarely hesitates to take the risk, and he pays the English author or his representative well for this advantage of simultaneous publication.

Now, what the Englishman is doing for us under cover of a strong custom, and so far undisputed law, let us do for him under sanction of a statute; and the problem is so far solved that we may safely leave all petty details to be adjusted by the laws of trade between the two countries, and the interests of the parties chiefly concerned. Simultaneous publication, then, in the two countries, is the fairest way out of our difficulties. It is so far compulsory that it makes the best foreign thought as immediately available in America as in Europe. It compels the publisher and author not to suit their own convenience, but to study the demands of two continents; and 'the progress of science' will receive by such a course an impetus which no method, planned for the advantage of the author alone, or the publisher alone, or the people alone, can possibly give.

H. E. Scudder.

INTERNATIONAL COPYRIGHT.

"The question of copyright, like most questions of civil prudence, is neither black nor white, but gray." So said Mr. Macaulay. Mr. Lowell says it is a question of robbery; the American copyright league, a question of piracy. Those who use these epithets base their assertions upon the ground that an author has a broader, more extensive right of property in his publications than in other property. That a man has property in the production of his brain which ought to be protected is admitted; but the extent of that protection must depend upon the public interest.

Scruton, in his book entitled 'Laws of literary property,' published in 1883 in London, says, "Utilitarianism is the groundwork of the science and art of legislation, and therefore the reason which justifies the enactment of any particular law is the ultimate benefit to result to the community from its conformity to such a law." This claim of property in books, as made by Mr. Lowell and the league, is of modern origin, and was not made until the early part of the last century, long after the introduction of printing, and is not recognized by any civilized government. Grants in the nature of copyright were first made to printers, to encourage the multiplication of books, and were subsequently made for the benefit of the authors. In England the courts have decided that, at common law, an author had no right of property in his publications, and that whatever rights he has have been created by statute law.

Our constitution provides that congress shall have power "to promote science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." The powers of congress are more limited than those of the parliament of Great Britain, which are not restricted by any constitution; and many grants which in England have been made 'for the benefit of authors,' would in this country have been unconstitutional. Every copyright is a monopoly. This proposition has been admitted by some of our authors, but denied by others who were probably ignorant of the meaning of the word. A monopoly is 'an exclusive trading privilege:' it is "the sole right or power of selling something; the full command over the sale of any thing; a grant from the sovereign to some one individual, of the sole right of making and selling some one commodity."

Every monopoly must be construed strictly, and should not be extended where reasonable doubt exists against the right. If authors limited their claims of property in the productions of their brains to the manuscript or a printed copy, no one would dispute their right to hold or lease or sell it; but they claim much more, — the monopoly of publication and selling, the exclusive right of multiplying copies everywhere and in every tongue and for all time, and they appeal to the government for aid in enforcing this right. Every nation has repudiated this claim as contrary to the interests of the public, and granted only such limited rights as it judged expedient.

General Hawley, who introduced the bill favored by the league, which gave the foreign author permission to publish abroad or in this country, realizing the weight of the objections made by the publisher and printer, that it would result in transferring the printing of all international copyrighted books to foreign countries, proposed an amendment to his bill, providing that every foreign book copyrighted in this country should be printed and published here. If the view of the league is correct, this amendment robs the foreign author of a part of his property by depriving him of the privilege of selecting the time or place of publication, or choosing his publisher. The tendency of this amendment would be to increase the cost of copyrighted books,

as the foreign edition, if made large enough to supply both countries, could be sold much cheaper here than a new edition printed in this country. It is asserted that this difficulty would be obviated by the tariff laws, as there is a duty of twenty-five per cent on books; but this is offset by duties on paper, type, ink, and other materials that enter into the composition of a book, and also by cheaper foreign labor.

There is apparently a wide-spread desire for an international copyright; but, so far as my observation extends, this wish is confined to English and American authors, or solely to parties who have a direct interest in the matter. England favors it because she will receive much greater benefit from our international copyright than America from an English international act, as ten English books are sold here for every American book sold there. A careful consideration of the whole subject will show that each country favors such legislation as is most conducive to its interest, and that the judgment of every author and publisher upon this subject is influenced, even if insensibly to himself, by the same motive. These authors and publishers are interested witnesses; and I believe there is not a single disinterested witness among those who have appeared before congress, favoring this measure.

This interest does not affect all authors alike; for some write because they cannot help writing, some for the purpose of benefiting the public, others for fame, while only a few write simply for money. Many of our old authors wrote before any copyright existed, and some of our best living authors would have written if we had no such laws. But authors cannot live on fame, and, like other workers, should be fully and amply compensated.

The copyright is of much less direct value, either to the public or authors, than is generally supposed. It is only the best authors who would suffer if we had no copyright. Mr. Holt, one of our largest publishers, states, that, out of every five publications, one is a failure; three barely pay the cost of publication; while the fifth, besides paying its cost, defrays the general expenses of the business belonging to the five books, and a profit to the publisher and author.

The indirect benefit is much greater; for the successful book is generally known to all, and incites authors to write and booksellers to publish. Special and scientific books often have few readers, and yet are of greater public benefit than more popular works. These are published in the expectation that the slow and steady sale during the life of the monopoly will pay the cost, and yield some profit and some fame to the author. How far this monopoly should be extended, and whether foreigners should enjoy it, are questions of expediency, and not of right. Wherever such extensions will promote science and the arts, they should be granted.

The direct benefits of international copyright are much less than those from our own copyright laws, while the direct injury will be very great, as is shown by the arguments in its favor. The reasons assigned by the league, at the hearing before the senate committee for an international act are: —

First, that it would increase the price of foreign books, and stay the flood of cheap literature that now deluges the land: second, that it would increase the demand for American works, raise their price, and thereby benefit the American author.

The opinions varied in regard to the increase in the price of foreign books that would be caused by an international copyright, though all agreed that the publication of cheap editions of new books would be discontinued. I requested a bookseller of New York to prepare a list of a considerable number of choice English books, exclusive of special and scientific books and works of fiction, with the prices of the foreign edition in London and New York, and of the reprint in this country. The aggregate price of 42 books in London was $339; of the same editions in New York, $545.80; of the reprint, $140.90. The average cost per copy was $8.07 in London; $12.90, same edition, in New York; $3.35 for the reprint. Many of these books have been reprinted in cheap editions at from ten to twenty cents per volume. If the act proposed by the league were passed, and the books published in London and sent here for sale, the prices would be regulated by the prices in London; for, if it were considerably lower here, the books would be sent back to England for sale. If published here, either by a London or American house, the price would not much exceed the price of American books of the same class.

Mr. J. R. Lowell, on the second day of the hearing, gave it as his opinion that the price of American books would not be raised, as the increased demand, when the cheap reprints were stopped, would yield sufficient profit to the publisher at the old price.

Mr. Holt, a publisher of New York, and Mr. Estes, a bookseller of Boston, agreed that the cheap reprints had reduced the demand for American books so largely that the inducement to write was insufficient.

In answer to these statements, it was shown, that, notwithstanding the great depression in all kinds of business for two or three years, the number of copyrighted books had increased from 8,000 in 1876, to 10,000 in 1885, or twenty-five per cent

in nine years, showing the same ratio of increase with our population, and that the books copyrighted in America exceed those copyrighted in Great Britain.

These figures prove conclusively that the cheap foreign literature has increased the demand for American books by enlarging the circle of readers and cultivating a taste for reading; that an international copyright must, as all its advocates admit, increase the price of foreign books, cut off the supply of cheap literature, and thereby check the growing desire for reading; that it would therefore be a tax on knowledge, and would neither be for the interests of the people nor of the American authors, and will not promote science and the useful arts.

GARDINER G. HUBBARD.

A NEW ROUTE TO SOUTH-WESTERN CHINA.

MR. HOLT S. HALLETT'S studies and explorations have revolutionized our ideas with regard to the geography of Indo-China. It was only six years ago that Archibald Ross Colquhoun was an unknown engineer in the public works department of British Burmah. He became interested in the geography of Indo-China, and accompanied an expedition sent by the Indian government to Zimmé in northern Siam. The information gathered on that journey is embodied in his 'Amongst the Shans.' This trip only whetted his appetite for adventure, and in the winter of 1881-82 he crossed southern China from Canton to Mandalay. His intention had been to connect this exploration with that made on the Zimmé expedition. The local Chinese officials, however, placed so many obstacles in his path, that, when almost within sight of the boundary separating the Shan states from Yunnan, he was obliged to turn back and to make the best of his way to Mandalay by the comparatively well-known route *via* Tali-fu and Bamo. As he was about to lead another expedition to the Shan country, he was sent by the London *Times* as a war correspondent to Tonquin. Unable to carry out his explorations in person, he found a worthy coadjutor in Mr. Hallett, a practised surveyor, who had been for years in charge of some of the most important divisions of British Burmah. The object these two men had in view was the finding of a practicable railway-route connecting India and some British seaport with the fertile portions of south-western China.

Indo-China — as the south-eastern section of Asia, lying to the south of China proper, is now conveniently termed — is divided into three great natural divisions, — the western, drained by the Irawaddy, Sittang, and Salwen, into the Bay of Bengal; the central, by the Meh-Kong or Cambodia River, and by the Meh-Nam, a river of Bangkok, into the Gulf of Siam; and the eastern, by the Son-tai, or Red River of Tonquin, into the Gulf of Tonquin. The valley of the Irawaddy is separated from that of the Salwen by a vast mountain-chain, while the eastern and central divisions are separated by a range or backbone running from the Tibetan plateau to the Malay peninsula. The lowest level of this latter range is in the latitude of Maulmain, a British seaport situated on the estuary of the Salwen. Now, as the most fertile portion of Yunnan is in the central division, obviously the best route for reaching it lies in crossing this great mountain-range in the latitude of Maulmain. This was the first conclusion at which the explorers arrived.

It is true that the line *via* Bamo and Tali-fu had hitherto been the favorite route. But, as Mr. Hallett points out,[1] although the distance between those two towns in a direct line is only two hundred and fifty miles, the shortest practicable route for a railway would be very nearly six hundred miles in length; and even then four passes between eight thousand and nine thousand feet above sea-level would have to be crossed.

Mr. Hallett's plan consists, then, in a railway running from Bangkok, the capital of Siam, up the Meh-Nam to its junction with the Meh-Ping; thence up the Meh-Ping by Raheng, where the line from Maulmain would come in, to a point near the confluence of the Meh-Ping and the Meh-Wung; then up the latter river, and across the water-parting between the Meh-Nam system and the Meh-Kong or Cambodia River, to the Meh-Kong at Kiang-Hsen, a town near the boundary between the Siamese and Burmese Shan states; thence over the plain bordering the Meh-Kong to Kiang-Hung, a town within fifty miles of Ssumao, a Chinese frontier town where Colquhoun was turned back.

The southern portion of this route was well known, owing in a great measure to the efforts of the American missionaries in Siam. Mr. Hallett's task, therefore, was to connect their explorations with those of Colquhoun. He carried to his work the skill of a practical engineer, and his surveys were made with such splendid precision that the cartographer of the Geographical society was able to construct an excellent map of northern Siam, which is reproduced in this number of *Science*.

Of course, there are several objections to this proposed route. It can be only indirectly con-

[1] "Exploration survey for a railway connection between India, Siam, and China" (*Proc. roy. geogr. soc.*, January, 1886).

nected with the Indian railway system by a line *via* Mandalay, the Chinwin valley, and a somewhat difficult mountain-pass. Then, again, the proposed route lies almost wholly within Siamese territory. But the government of Siam lives in great dread of French encroachments, and would probably welcome the English. At any rate, the Shans everywhere assisted Mr. Hallett, and expressed the greatest anxiety for better communications. Finally, it would tap only a portion of Yunnan, and would depend to a great extent for success on the building of railroads by Chinese themselves.

It must not be supposed that Mr. Hallett spent all his time in taking altitudes and other surveying work. He kept his eyes wide open, and has added vastly to our knowledge of the resources of Siam and of Siamese ethnology. In short, to use the words of Mr. Colquhoun, his work "has shed a bright ray of light upon a hitherto dark blot in our geographical knowlege, central Indo-China."

EDWARD CHANNING.

LONDON LETTER.

THE British association for the advancement of science will meet in Birmingham on Wednesday, Sept. 1, under the presidency of Sir William Dawson, LL.D., F.R.S., of the McGill university, Montreal. It will derive more than usual interest and importance from the exhibition of local manufactures within a radius of fifteen miles of the city, which is to be held in connection with it. The association has meet thrice previously in Birmingham, — in 1838, 1849, and 1865, — and on each occasion such an exhibition was held. To the example of the first of these are due all international and other exhibitions since conducted on so large a scale.

The names of the royal commissioners on the working of the elementary education act of 1869 have just been published. The list comprises twenty-two names, all of those interested from various points of view, in the working of the act. The present government deserves great credit for the constitution of the *personnel* of the commission, which is a very strong one, all the chief religious, social, and political interests being well represented thereon. Sir John Lubbock is perhaps the strongest and most influential advocate for a place for pure science as an instrument of education, that could be found. His utterances thereon always command the respect of the house of commons and of the country. Sir Bernard Samuelson represents technical education; Mr. Samuel Rathbone (chairman of Liverpool school board), the official school board; Mr. Thomas Heller, the body of teachers; and so on. Until this commission has reported, no legislation on the subject is likely to take place, although for a long time a feeling has been growing in the public mind that changes are necessary.

One result of the present educational system is that young persons leave the elementary schools at the ages of twelve or thirteen, and in the majority of instances go to work during the whole or a portion of the day, and scarcely ever pursue their education further. Inquiries set on foot by Canon Percival in Bristol, for example, elicited the fact that not five per cent of the children who thus leave school continue their education, in the scholastic sense of the term. To meet this difficulty, a system of evening classes has been devised, differing from such ordinary classes, inasmuch as the instruction is recreative, scientific, and practical. Attractive methods of teaching and demonstration are employed, in which the optical lantern has a large share. To Dr. Paton of Nottingham is mainly due the initiative of this movement, which was inaugurated for London at a crowded meeting held at the Mansion House on Jan. 16, presided over by the lord mayor, attended by the Princess Louise, and addressed by representatives of all shades of theological, political, and social position, from the Bishop of London and Mr. Mundella (who gave some startling figures as to the compulsory attendance on evening-schools in Germany) to representative workingmen. It was stated that in London alone there were nearly half a million (420,000) young persons to whom the scheme would apply.

An important change in the matriculation examination of the University of London was, on Tuesday, Jan. 19, recommended to the senate by convocation, which, on the motion of Mr. W. L. Carpenter, B.A., B.Sc., adopted the report of a committee upon the subject. Hitherto three scientific subjects have been compulsory, — mathematics, natural philosophy (so called), and chemistry, and no alternatives were allowed. Under the proposed scheme, the 'natural philosophy' is subdivided, and a portion only is made compulsory. It is headed 'mechanics,' and the syllabus comprises those elementary but fundamental notions of statics, dynamics, etc., which are at the basis of all science. A candidate is then allowed an option between three branches of experimental science; viz., chemistry, heat and light, magnetism and electricity. Chemistry, therefore, ceases to be a compulsory subject (a change which may meet with the outcry directed some years ago against the abolition of Greek as a compulsory subject), while encouragement is given to the study of other branches of physics.

Two very wonderful engineering works have just been brought to a conclusion, both of the same character, — tunnels under rivers. The smaller, but the one of more interest to Americans probably, is that under the Mersey, between Liverpool and Birkenhead, which was opened a few days ago by the Prince of Wales. On the morning preceding the opening, trains passed from James Street station on the Liverpool side, to Hamilton Square station on the Birkenhead side, in three minutes and a half. From the spot in the centre, where the mayors of Liverpool and Birkenhead many months ago shook hands over a piece of red tape, the tunnel extends two hundred and fifty yards in each direction in a perfectly straight line. The Severn tunnel is a much more gigantic work. As the river estuary is more than two miles wide, and from seventy to eighty feet deep, the subaqueous tunnel itself, and its approaches, extend to four miles in length. It has been constructed solely by the Great western railway company, at a total cost of nearly nine million dollars (£1,750,000), and its purpose is to facilitate the transfer of coal from the South Wales coal-field to Southampton, and other places in the south and west of England. Recently coal raised at Aberdare in the morning, was shipped at Southampton (on mail steamers, etc.) in the evening. The tunnel is not yet opened for passenger traffic. The greatest difficulty in its construction; arose from the intrusion of water, not from the Severn alone, but from springs in the Pennant grit and other geological strata, two or three miles away. The source of this water, in the early days of the tunnel construction (1877–78) was first shown by the present writer.

The scientific relief fund, which is held in trust by the president and council of the Royal society, is likely to receive a very welcome addition to its resources from Sir William Armstrong. The existence of the fund dates from 1859, and is in great measure due to the exertions of the late Mr. Gassiot. The interest is applied to the relief, under certain conditions, of such scientific men or their families as may from time to time require assistance. Since January, 1861, when the first grant was made, about £4,600 have been distributed in nearly one hundred grants. The present amount of the trust is £7,000, and Sir William Armstrong is very anxious to see it raised to £20,000. He therefore proposes himself to give half the sum required, provided that the fellows, with the assistants, if necessary, of other friends of science outside of the society, will raise the remaining £6,500. Several contributions towards this end have already been promised, and it is hoped that there will be no difficulty in making up the sum required, as the present income of the fund is by no means equal to the demands upon it. W.

London, Jan. 24.

NOTES AND NEWS.

The recent unusual cold weather in Florida, which caused so much injury to fruit-trees, is said to have destroyed in some places large numbers of fish in the shallow waters, benumbing them, and permitting them to be cast on the beaches in windrows.

— Dr. J. W. McLaughlin, president of the Texas state microscopical society, claims to have discovered sphero-bacteria in that peculiar southern disease known as dengue, or 'break-bone' fever, and further to have isolated and cultivated them.

— It is interesting to note, that, at a recent meeting of the Royal geographical society, Admiral Sir Leopold McClintock said that "it was a companion of Major Greely, the late lamented Lieut. Lockwood, who had made the nearest approach to the north pole yet accomplished."

— We call attention to a new map of the Kongo, corrected up to October, 1885, that has just been issued by Letts, Son, & Co., of London. The topography is laid down in great detail, the scale being 45 miles to the inch.

— The German parliament has again appropriated 30,000 marks, or about $7,500, to assist Dr. Dohrn's zoölogical institution at Naples.

— The New York *Herald* of Feb. 5 states that M. de Jousselin, commander of the steamship St. Laurent, reports observing on his last easterly voyage a magnificent aurora borealis far out on the ocean. The St. Laurent was at the time in latitude 44° 20′ north, longitude 57° 3′ west. The brilliant phenomenon extended from west-north-west almost to north-east, the luminous rays, white and red, mounting up to about seventy degrees above the horizon, and stars of the first magnitude were visible through the blue rays. The observations show that the aurora occurred in connection with a cloud-covered sky and in the rear of a storm which had a short time previously passed the steamer.

— The progress of psychical research has been most marked in England, but has not failed to attract attention in Germany, France, and the United States. A journal especially devoted to the historical and experimental "begründung der übersinnlichen weltanschauung auf monistischer grundlage," has been established in Germany. The journal is called *Sphinx*, and will be issued monthly by L. Fernau of Leipzig. Dr. T. U.

Hübbe-Schleiden is the editor, and associated with him are Alfred Russel Wallace, F.R.G.S., Prof. W. F. Barrett of Trinity college, Dublin, and Prof. Elliott Coues of Washington.

— Those interested in psychical research may be interested to know that the Proceedings of the American society are on sale with Cupples, Upham & Co., at thirty-five cents each.

— An international copyright law has never been defeated in either house of congress, nor has one been discussed in either since Henry Clay, in 1837, brought in the first bill of the kind. Now and then there have been hearings before congressional committees; and a favorable report was made in 1868, which was never acted on, however; and an unfavorable report, based on the narrow view of the constitutional power of congress, was later made by Senator Morrill of Maine. In the last congress the Dorsheimer bill for international copyright, pure and simple, without any conditions requiring the printing in this country of copyrighted books, was favorably reported, but congress adjourned without action. Before the present congress, there are now two bills, — one offered by Senator Hawley, similar to the Dorsheimer bill; and the other by Senator Chace, which is intended to favor the manufacturing interests.

— Prof. E. D. Cope is now engaged upon a 'Catalogue of the amphibians and reptiles of Central America and Mexico,' which is shortly to be issued. It will be the most important and complete contribution ever published on the amphibians of these two countries.

— The commerce committees of both houses of congress have decided to report favorably the bill proposing to send a commission to Mexico and South America to investigate the question of yellow-fever inoculation. Two of the members of the commission will be selected from the government service, and a third will be chosen from civil life.

— The annual report of the National academy of sciences for the past year was submitted to the senate on Monday, Feb. 8.

— The U. S. geological survey has at present but two exploring parties in the field, owing to the severity of the winter. One of these is in western Georgia, engaged in studying the southern extension of the archean formations, under the charge of Professor Pumpelly; the other, under the direction of Mr. Garlick, is making a topographical survey of the valley of the Gila, California. Experience has shown that winter is the best time to work in this field.

— Readers of *Science*, old and new, may be interested in some brief statistics concerning the paper, drawn from the editor's books. During the nearly three years since its establishment, up to January, 1886, payments of greater or less amounts have been made for contributions to the columns of the paper to four hundred and twenty-seven different persons outside the editorial office. Of course, this number would be materially increased if contributors who have not been paid were to be included in the list. The number of persons who have repeatedly furnished contributions on direct request of the editors is one hundred and forty-four. These facts furnish distinct evidence of the place that *Science* is taking in American literature, and of the breadth of the field it cultivates.

— The twenty-third bulletin of the U. S. geological survey, by Messrs. R. D. Irving and T. C. Chamberlin, treats of the relation of the Keweenaw series and the Potsdam sandstones. Geologists have held very different views concerning the relation of these beds, as the readers of *Science* will remember, from the discussion in vol. i. The writers give a clear exposition of their views, with full descriptions and history of the subject, illustrated by a number of excellent engravings. Their conclusions, briefly, are as follows. The Keweenaw series very greatly antedated, in its formation, the Potsdam sandstone, and occupied a lapse of time immensely vaster, and was a period characterized by some of the most remarkable displays of igneous activity of which the world has been a witness. They were succeeded by a long interval of erosion, before the close of which a longitudinal fault was developed along the face of the present trappean terrane. Subsequently they were submerged beneath the Potsdam seas, and the eastern sandstone was laid down unconformably against and upon the Keweenaw series. Later, after the deposition and erosion of the Trenton, and possibly other members of the Silurian, minor faulting took place along the old break. Should these ingenious conclusions be sustained, an important change must be made in the stratigraphy of the lower Silurian. In any event, the work is to be commended for the clearness with which the facts are presented and the conclusions drawn.

— The last annual report on the vital statistics of Selma, Ala., gives some interesting facts in regard to the death-rate and disease among the whites and blacks. The population of the city is a little less than ten thousand, more than one-half of which are negroes. The death-rate from all causes for 1885 among the whites was 15.1 per thousand, while among the blacks it was 28.65. Malarial fever was three times, consumption four times, meningitis and Bright's disease, twice, as

fatal among the blacks as among the whites; while diphtheria, singularly, was three times as fatal to the whites as to the blacks.

— The New York academy of sciences announces a lecture, free to the public, at the library building of Columbia college, on March 8, by Prof. George F. Barker, on 'Radiant matter.'

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

International geological congress at Berlin.

I send you the following from a paper on the 'Third session of the International geological congress' (*Journ. math. phys. nat. sc.*, Lisbon), sent me by the author, Mr. Paul Choffat, one of the most important and independent members of the late congress. His strictures are only too just, and his criticisms are well worthy of attention.

After briefly sketching the incidents connected with the origin and the assembling of this congress, already familiar, M. Choffat remarks, "A goodly number of the 255 persons, representing 17 countries, came to make a scientifico-artistic visit to Berlin, or to make numerous acquaintances among their *confreres*. These must have been completely satisfied; but it is otherwise with those who came to hear treated the subjects which formed the end of the congress. These, I fancy, will unanimously agree that this end was a little neglected." He reminds his readers how important it is, and how much time it saves, to discuss questions among representatives of different countries where the answer comes at once, instead of waiting for months, or even years; and he complains that half of the afternoon sessions were devoted to scientific communications on subjects not particularly interesting to the congress, and which will be more profitable to those who read than to those who heard them. "Granting that there was an average of an hour and a half to each *seance*, in the four consecrated to debate there was a total of six hours." He complains that the report of the sessions at Zurich and Foix simply stated that a number of answers had been received, both from the national committees and from men of science acting spontaneously, but that the nature of these answers and the names of the *savants* were not given. In answer to the reproach of the international committees' report, that many national committees had not furnished the material that was expected of them, he says that the reason of this is plain, and unfortunately exists yet: it is, that the limits of the divisions have not been fixed; and, after taking the trouble to send a map made on this or that division, one is in danger of receiving it back again with the request to make another copy. In the last four *seances*, which ought to have been devoted to the discussion of questions of nomenclature, only the point of view of the map was considered. This ought to furnish those who look upon the map as simply a first edition, to serve as a basis for the discussions of future congresses, food for reflection. He thinks that the first mistake was to commence the publication of a map without settling the principles on which it should be based. He gives the following summary of the constitution of the three congresses thus far held: Paris, 194 Frenchmen and 110 foreigners, representing 20 countries; Bologna, 149 Italians and 75 foreigners, from 16 countries: Berlin, 163 Germans and 92 foreigners, representing 17 countries. "What geologist would sacrifice his convictions to such a heterogeneous assemblage?" He thinks that not only ought the number of those voting to be much reduced, but they should not vote by countries. Instead of this, he proposes that they should vote by geological basins, and that the voters should therefore be different for every geological question raised. He concedes that it would be very difficult, if not impossible, to create such a bureau or bureaus; but he thinks that some approach to it might be made, even if voting was not permitted, but the subject was elucidated by the longest and freest discussion of each subject possible. Finally, he thinks that a great centre ought not to be chosen for the place of meeting of the congress, as the distractions are too great, and therefore he is in favor of Professor Hughes's proposition (which, however, was voted down) to hold the next session in Cambridge instead of London. M. Choffat concludes this somewhat dissatisfied commentary on the congress by acknowledging, that, "in spite of all the weak points of the three sessions of the congress, they have done much for the science of geology directly and indirectly;" and as an example of the latter influence he points to the splendid map of France, on a scale of 1:500,000, undertaken by geologists who have not any official mandate, and yet have not shrunk from the task of its publication.

Permit me to replace by my full name the first two letters of it, signed to the translation of Stelzner's letter in your issue of Jan. 22.

PERSIFOR FRAZER.

Philadelphia, Feb. 3.

Cliff-picture in Colorado.

Professor Tillman's note on a cliff-picture in Colorado (*Science*, vii. p. 80) leads me to send this account of the same object from notes made on the spot in August, 1871, and published in *Old and new*, a Boston magazine, since discontinued, in December of that year: —

The Bear Rock is a comparatively smooth face of a sandstone bluff that extends about sixty feet above the water, from which it is distant a hundred or more yards. Upon the exposed surface of the rock, about ten feet from the bottom of the cliff, is an excellent life-size representation, in profile, of a three-year-old cinnamon bear. The figure is dark brown, approaching black, being darker on the anterior half. The outline is distinct and perfect, unless exception may be taken to a slight blurring at the bottom of the hind-feet and a somewhat pronounced excess of the claws of the fore-feet. From the tail to the nose the length is about six feet, and the height at the shoulders is about three and a half feet. These are merely approximate dimensions; the writer having no facilities for exact measurement at the time of his inspection, Aug. 8, 1871. The legs are all visible, and the head points straight to the front, as if just about to take, or just having taken, a step. The fore feet are on a slightly higher plane than the hind ones, as if on rising ground. The expression is one of surprise and alarm: the head is thrust forward and slightly upward, the ears are sharply cocked forward as if on the alert, and the whole attitude displays the utmost fidelity to that of a bear in some excitement and apprehension. There is no room for a moment's doubt as to the animal, or the state of mind in which

it is. The figure is of full size, but, until scrutinized, appears smaller, being dwarfed by the magnitude of the rock on which it is depicted. . . . The Indians look upon it as great or strong 'medicine.' Beads and broken arrows are still to be found below it and in the crevices near by, apparently placed there as propitiatory offerings. Deep gashes in the subjacent sandstone show where the savages have for a long period sharpened their knives in its presence, while rudely carved, not painted, figures on the rocks are apparently the autographs or totems of individuals or bands. The popular explanation among the white settlers is, that it has been painted by the Indians. This is inconceivable by those having any intimate knowledge of them, from the utter absence of artistic skill among the savages, as shown by the almost unintelligible hieroglyphics near at hand, and from their want of familiarity with paint as durable as this pigment. The fidelity to nature of this figure is utterly beyond any ability ever known to be exhibited by them. It has been suggested that it was painted by the Spaniards, who explored this region, and described this river as Rio del Animas in what is now nearly a traditionary period. But, if a conceivable motive could be supplied, there are local reasons why no artist would place a picture just where this is found.

The surface on which it is depicted is slightly irregular and roughened, while an absolutely smooth one can be found a few feet above; and, as the existing figure is so far from the ground as to require a staging from which to be painted, the same staging could easily have been carried up the small additional height required. There is no reason why the figure should be slanting, in the absence of the accessory of sloping ground. An artist who had the skill to create this could have made a much more effective picture by giving it a somewhat different posture, or by adding a figure or two. A deep yellow stain or vein in the stone runs longitudinally through the figure, marring it as a work of art. This would have been avoided by placing it a little higher up, or it might have been obscured by the use of more color directly upon it. A small portion of the rock, where the color is deepest, was removed some time ago; and, having been carefully ground to powder, it was burned without the smell or any sensible sign of paint being elicited.

To the mind of the writer it is clear that the object is not artificial; but these details are mentioned that those who have no opportunity for personal inspection may have some basis of judgment. If this reasoning is correct, of course the figure has been placed there by some natural cause, and the most probable seems to be lightning. . . . It would appear that a bear had taken shelter under the somewhat overhanging ledge, or had simply stopped near by at the time, and, while startled at the close display of lightning, was by that agency depicted upon the solid wall. If not, what is the explanation? At places where the rock has scaled, the color shows to the depth of one-sixteenth to one-eighth of an inch, according to the closeness of its texture. White barbarians are already destroying this natural curiosity. It affords a tempting mark to passing ranchmen, and it is fast being destroyed by their well-aimed shots. Others, in sympathy with that vandalism that befouls the fairest monuments of civilization, chip off convenient projections, and pencil their little names on the fresher rock beneath. What the superstition of the red savage has preserved, the irrational iconoclasm of his white brother destroys. The writer, since preparing this paper, has been told that a scientific party visited the Bear Rock in 1867, and attributed the picture to electricity.

The light spots in the reduced print from Captain Anderson's photograph show the scaling due to violence. The original picture, of which I have a copy, shows many bullet-marks not reproduced in the reduction. The outline of the upper part of the neck in the reduction does not closely follow the curve of the original, and the comparative coloring of the fore quarters is too intense. It is said that there is a somewhat similar picture of another animal about fifty miles farther up the Purgatoire; but this I have not seen, nor have had definitely described.

I am not prepared to defend the suggestion of electrical agency made above, and I believe scientific opinion would not accept it. But a careful study of the object *in situ*, on more than one occasion, convinces me that it is not the result of human agency, and it certainly is the accurate outline of a bear.

Davids' Island, N.Y., Jan. 30.

ALFRED A. WOODHULL.

A scientific corps for the army and navy.

In the army, as well as in the navy, we have several corps or departments which have a greater or less claim to being called scientific. Since the earliest days in the history of our army and navy, we have also had men of the highest scientific attainments appear in the line of these two organizations. But the question may be asked now, Is not the time approaching when we should have, strictly speaking, a scientific corps for these two institutions of the public service? Their past history goes to show that every twenty or twenty-five years, either one, produces a limited number of men, who, through their writings and influence, compel us to recognize them as scientific leaders in certain lines of research, and among the ablest of those concerned in the progress of learning and the advancement of knowledge.

It is not the object of this letter, nor will the space admit of it, to refer, either by name or deed, to any of these persons. A moment's reflection on the part of any scientific man will recall to his mind whom they are, both the living and the dead, many of the works of either are imperishable. Our country does not stand alone in this matter, for we find the same applies to the military organizations of other nations. With ourselves, however, it seems to me that without any particular legislative violence, much might be accomplished whereby the country would derive a greater amount of benefit from such men, and the national credit for wise and sound legislation be considerably augmented.

The formation of a scientific corps, open to the recognized scientists of either army or navy, would remove many of the present existing disabilities that these persons have now to contend against. Then should the scientific bureaus of the government ever be grouped as a department of science, the way will be properly opened for the work of these men, and they will naturally gravitate to their proper spheres of action, without conflicting with laws that can easily be construed to send them elsewhere.

To better show the wisdom of the step proposed, and the reasons why science should recommend it for

her own sake and good name, let me lay before you one or two examples demonstrating how the disadvantages I refer to, are due entirely to existing laws, and what we would gain by the change in them. A very excellent procedure on the part of the government is now in force, which consists in sending, at stated times, a certain number of midshipmen of the navy to the Smithsonian institution. Here steps are taken to instruct them in marine zoölogy or other matters from which science may be furthered some day, as the opportunities of these young men may afford. Those only are chosen who appear to promise the most, so far as the object in view is concerned. In the long-run, and after all degrees of success of this scheme have revealed themselves, we may obtain, sooner or later, in this way, a man who is really a naturalist in every sense of the word. If I am not mistaken this has already been done, for I have sufficient acquaintance with the young man to say so. He has produced excellent work, published some creditable things, and described several new species. Now no law strictly defines the disposition that shall be made of this one success, in a hundred perhaps, but worse than this, it is more than likely that the operation of the ordinary military impedimenta will defeat, in a very short space of time, what is really a splendid investment on the part of the government. If it falls to his lot to be placed aboard of a man-of-war, under some one who has no appreciation of the importance of such things, and he makes the attempt to utilize his knowledge, it is again more than likely that he will be told that if he wishes to follow such pursuits he had better resign. This proposition is discreditable, I think, any way we look at it, for surely the navy will gain a greater degree of respect for having among their number one who shows ability in any particular line of research, and it certainly seems that the government fails in its duty in not turning such a person to the best account, to say nothing of the interest it would pay her on the original investment.

Precisely the same impedimenta constantly confront the scientific investigator in the army, and my observations upon all that such workers have to contend against in civil life, lead me to believe upon comparison, that they can never entertain any conception of the thousand and one contrivances that surround him, to defeat, and in no way further, his efforts. Not that such persons would object to any thing that the struggle for existence might impose in the natural order of things, when one grows the wiser and the better for the test, but the distractions I refer to, are exceedingly pernicious, and of a far more serious character. Say, however, an ordnance officer wins his reputation as a pathologist, and just such parallel cases have occurred, and always will occur, what happens? — why in some roundabout way we soon find him in the laboratory, but unfortunately with an order over his head directing his return to the arsenal. Now this is bad, for if he goes back to the arsenal the habit of his mind, in spite of his personal integrity, will prevent him from being a good ordnance officer, while on the other hand, the government has abundant need of efficient pathologists, and here is one perhaps whose fame is worldwide. If he be retained in the laboratory the present law demands that he *do good work by stealth*, which is very bad for the investigator, and not a creditable thing for the country, for we should be enabled to do such things entirely above board, and be able to express our pride in them as a people, without apology, besides.

It would be superfluous in me to attempt to point out the least part of the incalculable benefit that the work of these scientists has been to their country, in the vast majority of instances, nay, to the world at large, and I must believe that the establishment of the scientific corps, that I suggest, would be a step in the right direction.

To say one of the smallest things in its favor, it would obviate the necessity of the recurrence of the ridiculous farce we were, as a nation, unavoidably guilty of, in offering Lieutenant Greely after his arduous expedition, a position in the quartermaster's department,— or such things happening, as occurred only a short time ago, an officer being reported to his department commander, because he was found guilty of pursuing lines of research foreign to his duties, and publishing the results of his investigations, notwithstanding the fact that it was proven that said duties had not been neglected in consequence.

The number of officers composing this corps should be limited to thirty, and transfers to it from other departments or the line, should be made only upon the consent of the officer. Officers should be allowed, however, to apply for such a transfer, and such application should be given due consideration by the National academy of sciences, which constitutes the highest advisory body to the government we have to decide such matters.

If the individual is found worthy of such distinction, and his work passes the required test as now applied by the academy, and he be willing, then the transfer should be effected at the earliest practicable date.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Jan. 25.

Science and Lord Bacon.

A year ago the honorable Ignatius Donelly appeared in Washington with a documentary proof that the plays of Shakspeare were written by Lord Bacon. I did not hear Mr. Donelly's lecture, but several ladies informed me that they believed there was 'something in it.' As 'Bacon's essays' was one of the first books I bought and read, it occurred to me to examine his scientific work; but there is very little, and his single experiment appears to have been the stuffing a fowl with snow, which brought on the chill that caused his death. It seems to me that Bacon's services to science have been greatly overestimated, and that Macaulay's declamation on this point is as absurd as Mr. Basil Montague's arguments to prove that his hero never took bribes. A writer of so much intelligence as Bacon, and yet one who ridiculed the Copernican theory after the discoveries of Galileo, could have had but little scientific spirit; although it is to be remembered that the England of his day was far behind Italy and France in scientific knowledge. Can it be that in this matter we have been imposed on by the fustian of English writers, of cyclopedias and school-books?

ASAPH HALL.

The competition of convict labor.

In his reply to my criticism of his views on the convict-labor problem, Mr. Butler denies that he consciously stands on the grounds of the ruling order of political economy. He holds that his stand-point is that of 'practical ethics' (*Science*, vii. No. 157).

What is that? There are differing schools or codes of ethics both in theory and practice, and the only sense that the term 'practical' can be used in relation to ethics is that it may designate the kind of ethics in practice in the time and place in question. This in our country and time, and special field involved, is the ruling order of political economy. This is the practised one as opposed to the professed one, which is Christian, and most decidedly different from the former.

He defends this questionable position with equally questionable figures. There are no 'official' figures compiled by any such men as our practical politicians (especially in matters where they may be assumed to be interested) which any scientific man would accept as evidence to controvert the constancy of the order of nature. The assumption that contractors would hire convicts in trades which are plentifully manned by free laborers, except for the one reason, greater cheapness, involves just such an infraction in the order of nature as is expressed in the commonplace reference to water running up hill.

But even so, says Mr. Butler, the total proportion of convict labor to free is only 1.1 per cent. "And it is this minute percentage of competition that has caused all the hue and cry against convict labor."

This is a peculiarly misleading way of 'treating' the figures. The pressure of convict competition has been felt in certain trades of certain localities, such as shoe and hat making of the state of New York. There the percentage has been large enough to injure both employers and employed, and, if Mr. Butler wishes to show the causelessness of the 'hue and cry,' he ought to show the percentage in special trades and localities. A shoemaker does not compete with a tinsmith, nor does the purely local trade of one locality interfere with that of another.

It is true, however, that even the unaffected trades have taken up the 'hue and cry;' and that is because their ethics differ from the 'ruling school.' where the principle, 'every one for himself,' is held, and instead of that their ethical doctrine is, 'an injury to one is the concern of all.'

E. LANGERFELD.

Amongst a number of inferences, the above communication contains one statement, and that not bearing on the question of the general merits of the contract system, but on its application to the hat and shoe trades in the state of New York. Whether any modification of the system in this point of its application is advisable, experience must determine; perhaps a restriction as to the number of convicts to be employed in any one industry would be desirable.

The official figures as far as these two industries are concerned are as follows. In 1879, 320 convicts were employed in making hats in the state of New York, while 5,267 free workmen were engaged in the same industry; thus the competitive force of the convict labor was about 4 per cent. In 1879, 1,927 convicts — 1,885 males and 42 females — were employed in New York prisons (at Sing Sing, Auburn, and Clinton prisons, at the penitentiaries at Albany, Brooklyn, Rochester, and Blackwell's Island, and at the western house of refuge at Rochester) in the manufacture of boots and shoes. According to the census of 1880, 26,261 is the number of free laborers at boot and shoe making in New York state. This shows the competitive force of the convicts' labor in this instance to be something over 4 per cent. This amount is still small, though considerably greater than the figure (1.1) which we found to represent the competitive force of all the convict labor in the United States, without regard to particular industries.

Your correspondent has selected that example in which competition is greatest, but even then 4 per cent is the highest figure reached, and surely it is not so very formidable. I have had some hesitation in adducing fresh figures, for fear that they may be summarily rejected as useless, because they do not fit in with some person's ideas as to how the 'course of nature' ought to go.

NICHOLAS MURRAY BUTLER.

The festoon cloud.

I have been much interested in the recent articles in *Science* on festoon clouds. In August, 1884, I witnessed a remarkable exhibition of this description over Vineyard Sound, between the shoulder of Cape Cod and Martha's Vineyard. It was in the morning, about nine or ten o'clock. The sky was overcast with clouds betokening a shower. A thunder-cloud was in the north-west, from which occasional mutterings were heard. High over the water was a dark cloud, from which depended portions of the cloud like great curtains. These depending portions grew lighter in color, and thinner in texture, until, when within about one hundred feet from the water, they frayed out into a fringe-like appearance. Between these curtains the atmosphere was comparatively clear, up to the dark cloud above; but, as the depending portions approached the dark cloud, they grew in dimension and density, forming arches from one to the other. The dark cloud extended south-west and north-east in the direction of the axis of Vineyard Sound, but the depending clouds were at right angles to this direction. I secured a sailboat, and sailed underneath these clouds, and the display was truly wonderful. The fringing of the lower portion of the depending clouds was very beautiful, and the high arches between were impressive. This exhibition was followed by a severe thunder-storm, as I remember. There seemed to be currents of air of different temperatures, but, in the absence of instruments, I was unable to make any record of this. I recall that the wind was unsteady and shifting at the surface, which required careful management of the boat.

J. M. ALLEN.

Hartford, Conn., Feb. 6.

Correction of thermometers for pressure.

Imperfect instruments, faulty methods, and personal errors have caused the introduction of a great many inaccuracies in scientific literature, and entailed great labor in their correction and the repetition of experiments. This is especially true in the case of physical constants. It is manifest that in this work of redetermination the most painstaking accuracy should be aimed at, and every possible source of error avoided. Otherwise the work must be repeated at some future day, and our theories based upon uncertain constants will have but little force.

It occurred to one of us (Dr. Venable) that a source of error in thermometric readings, not generally corrected for, might lie in the effect of pressure upon the glass bulb containing the mercury. No reference to any such corrections could be found in the books at our command, and we resorted to experiment to test the amount of the possible error.

A few experiments, carried out with some fine

Geissler thermometers, showed for a spherical bulb an increase of 0.16, and for a cylindrical bulb an increase of 0.27, of a degree Fahrenheit, for an additional atmosphere of pressure. Clearly, the amount of increase will depend upon the nature of the glass bulb, its thickness, size, and shape.

Many observations on vapor-pressure, on boiling-points under increased or diminished pressure, meteorological observations at unusually high stations or in mines, are subject to this correction; and, as no general correction will be satisfactory, each thermometer will have to be separately tested.

We have written to the signal-service bureau for information on this subject, and find that they 'have the matter under consideration,' and are making experiments. Besides, we have been referred to papers by Loewy in Proceedings of the Royal society, 1869, and by Marck, International bureau of weights and measures.

We write now to point out this source of error to readers of *Science* who may not have noticed it, and to ask if any can refer us to further memoirs and observations on the subject.

F. P. VENABLE.
J. W. GORE.

University of North Carolina, Jan. 23.

Is the dodo an extinct bird?

Since the publication of an article of mine upon the origin of birds, which appeared in the *Century magazine* for January, 1886, there have come to me a number of interesting letters questioning the fact that the dodo is entirely extinct. From among them I select one recently received from Dr. William Barr of Bovina, Miss. My correspondent tells me that he clipped not long ago, from an English newspaper, the following item: "Mr. Manley Hopkins, consul-general of Hawaii, writes to an English journal, 'By my papers received from Hawaii, I observe that among some birds brought by the schooner Fanny from the Samoan group was a single specimen of that *rara avis in terra*, the dodo. I am sure your readers will be interested to hear that this bird, supposed to have become extinct more than a century ago, still lingers in the little-explored Samoan Islands of the South Pacific.'"

A number of continental naturalists, who, no doubt, have arrived at their opinions through the rumors brought home by explorers, have predicted that the dodo will some day be found to be one of the forms of the existing avifauna of the island of Madagascar.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Jan. 20.

Evidences of glacial action on the shores of Lake Superior.

Evidences of glacial action are abundant about Peninsula Harbor, on the north shore of Lake Superior. The tops of the low islands, and of the hills along the shore, are rounded in a striking manner. Below the surface of the water well-preserved grooves and scratches extend in a general north-east and south-west direction. The crevices in the granite rock which extend across the glacial markings have their northerly sides nearly intact, while the sides opposite are considerably worn. Where the crevice extends in about the same direction as the glacial mark, both of its sides are gouged out.

On Verte Island, Nipigon Bay, Lake Superior, a well-preserved beach of water-worn pebbles lies, as near as could be determined by rough measurement, two hundred and eighty feet above the present level of the bay.

A. A. CROZIER.

Grand Rapids, Mich., Jan. 26.

Professor Newcomb's address before the American society for psychical research.

In view of the utterances in the last two numbers of *Science*, called forth by my address before the American society for psychical research, some comment by me may not be inappropriate.

Of the two criticisms upon my address, which are put forth in the comments of Jan. 22, one seems to me well founded. It is that directed against my definition of thought-transferrence as something which is supposed to take place without any physical connection between the acting and the percipient minds. *Science* correctly points out that the absence of a physical medium of transfer is not implied in the doctrine of transferrence. But, while conceding this, I wish to point out that this error no more affects my conclusions than a typographical error would. The point to which my whole discourse was actually directed was that of thought-transferrence through any hitherto unrecognized channel, whether material or not. In other words, I inquired whether the observed phenomena required the admission of any new law of nature in order to explain them.

Your other criticism is in these words: "He places much emphasis, for instance, on the extreme rarity of thought-transferrence in the ordinary course of life, and implies, somewhat sarcastically, that it ought to be much more frequent."

I can find in my written paper no justification for any such remark, and cannot even guess what passage it refers to. I did, indeed, point out the well-known and obvious fact that very rare phenomena become frequent when we learn how they are produced, or how they may be observed, and remarked, that, were thought-transferrence real, we should expect to learn how to produce it at pleasure as its conditions became better known. The great fact which I pointed out is this: after three years of pains-taking labor by the English society, and one year of our own, no one shows us how to produce or observe thought-transferrence, nor indeed tells us any thing about it that we did not know before.

Professor James's remarks in *Science* of Feb. 5, are directed mainly to certain reflections upon the English society, for which I am not responsible to any further extent than as having made the remark which led to them. At the same time the question seems to me not devoid of interest. The ground which I take is, that the parts of the reproduced figures made by blindfolded percipients fit together in a way which could scarcely have been possible unless the percipient either saw the drawing he was making or had a knowledge of his work by some agency unknown to science. Professor James is not ready to concede this, but apparently claims that the muscular sense would have proved a sufficient guide, and suggests that I try the experiment myself. I beg leave to assure him that I did not venture on my conclusions until I had tried it. I cannot make any such drawings as those given on pp. 89 and 95 of the Proceedings of the English society by the muscular

sense. I should be interested to know from Professor James, whose superior knowledge of this subject I of course recognize, if others can do better, and if any blindfolded draughtsman at his command can make consecutively four such pictures as those on p. 95 with entire success, or can draw five lines out of six through the angles of an invisible hexagon as accurately as is done on p.89. If so, my remark has no particular point. If not so, but if it be considered that the draughtsman must have seen the picture as he was drawing it, then the fact will be more valuable for what it suggests than for what it proves. It will suggest the question why the committee who conducted the experiments laid such stress on the percipient being blindfolded when he could in fact see. S. NEWCOMB.

Sea-level and ocean-currents.

One has so little practice in differing from Professor Ferrel that it is difficult to know how to begin; but there are some points in his recent letter on 'Sea-level and ocean-currents' (*Science*, Jan. 22) that do not carry conviction. The first is, that the small head of water resulting from the superficial difference in temperature of the ocean in high and low latitudes should be as effective as he claims it to be in producing ocean-currents, and especially in producing the existing surface currents whose circuits seem to be so nearly completed without descending to great depths; for the supposition that there is a gradual rising-up of deep water at the equator in any thing like sufficient volume to feed the currents that flow thence towards the poles is not warranted by the known distribution of surface or deep-water temperatures. Professor Ferrel ascribes the origin of the southward return current from France past the African islands to an elevation of the sea-level on the western coast of Europe, where it is heaped up by the eastward pressure of the North Atlantic drift; but the homologue of this current in the South Atlantic is a well-marked stream that turns towards the equator, although it finds no land-barrier to its eastward passage beyond the Cape of Good Hope. According to the convectional theory, it is not needed at the equator, for the water that it supplies to the Gulf of Guinea ought to rise there from the abysses: it seems preferable to refer it to the winds, with which it accords very well, provided there is reason for thinking that the winds could carry it.

The effect of the winds seems to be visible in changing the direction of the currents in the Indian Ocean with the changes of the monsoons, and in altering the area of the counter-current of the equatorial Atlantic as the position of the trade-winds shifts with the seasons. A brief examination of Strachan's charts of the 'Currents and surface temperature of the North Atlantic Ocean,' published by the British meteorological committee, 1872, shows the mean velocity of the return current between Portugal and the Azores (latitude 37°.5 to 40°) to be seventeen miles a day in the four cold months, and only nine miles for the hot months. The winter average is based on forty-one determinations; the summer average, on ninety-eight.

The sufficiency of prevailing winds to establish deep currents has been discussed by Zöppritz, with results that are approved so far as I have read. His paper on 'Hydrodynamic problems in reference to ocean-currents' (Wiedemann's *Annalen*, iii., 1878, 582) furnishes a basis for the following statements. If an ocean of great depth acquire a certain velocity of motion at the surface, it will take 239 years to gain half this velocity at a depth of 100 metres; at the same depth, even a tenth of the surface velocity will not be reached for 41 years; at a depth of ten metres the times will be 2.39 and 0.41 years. But, given sufficient time, the effect of a continuous horizontal surface motion will be felt to the bottom, the velocity finally attainable decreasing with the increase of depth. From this it appears that the effect of any variations from the prevailing forces (winds) applied at the surface will be propagated downwards very slowly, and that below a very moderate depth the motion of the greater mass of the current will depend on the mean direction and velocity of motion in the surface water. To establish the currents as they now exist would require something like 100,000 years (pp. 598, 601, 607). According to Zöppritz, therefore, we should not expect to find significant changes of level in Lake Ontario as a result of our frequently shifting easterly and westerly winds; nor in the Atlantic, on account of the difference in the velocity of the wind, winter and summer. The attitude of the greater mass of water must be in both cases adjusted to the action of the mean annual winds. In view of these and other reasons, it does not seem probable that the 'strongest winds have no sensible effect' on the ocean-level and the ocean-currents. Doubtless both gravitative convection and wind friction have a share in causing the surface currents, but the latter has the larger.

W. M. DAVIS.

Cambridge, Jan. 31.

Association of sound and color.

A friend who is peculiarly sensitive to music tells me that in listening to an orchestra he invariably sees a brilliant yellow star when the triangle is struck, and a bluish green circle (hollow) at the clash of the cymbals. As I understand him, these appear instantaneously, and then fade out little by little. I should be glad to know whether any of the readers of *Science* have similar experiences. BRADFORD TORREY.

Boston, Feb. 9.

Tadpoles in winter.

In response to the inquiry of H. M. Hill in *Science*, vii. No. 157, I would say that for the last ten years we have been able to get tadpoles in the small streams on the Ithaca flats just before they were covered with ice in the autumn, and as soon as the ice had disappeared in the spring. There has been no trouble in keeping them alive in an aquarium in the laboratory through the winter. Those so kept have transformed, and have proved to be tadpoles of Rana catesbiana, the common bullfrog. S. H. GAGE.

Anat. lab. Cornell university, Feb. 8.

In the frozen marshes surrounding Fresh Pond, Cambridge, I saw a large number of tadpoles under the ice, and in the clear water around the edges, about the last of January. The weather for a few days previous had been very warm for winter, but this had been preceded by very cold weather. I had always supposed, as your correspondent, Mr. Hill, does, that they were only found in warm weather, and I was considerably puzzled. WM. A. FORD.

Boston, Feb. 9.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 12, 1886.

PRIMITIVE MARRIAGE.

PROF. W. ROBERTSON SMITH, in his 'Kinship and marriage in early Arabia' (Cambridge, *University press*, 1885), may be regarded as having given the latest contribution to the controversy going on between those who uphold the opinions of the late Lewis H. Morgan in regard to the origin of human society and the primitive form of marriage, and those who support the views of the late John F. McLennan upon these subjects. To explain fully in what these differences consist would require too much space, so that we must content ourselves with stating some of the main points of disagreement.

Mr. Morgan, in his 'Ancient society,' maintained that the primitive family, which succeeded to a condition of promiscuous intercourse, was a consanguine one, founded on the intermarriage of brothers and sisters in a group. This was followed by the Punaluan or Hawaiian family, in which several sisters or brothers had groups of husbands or wives in common, who were not necessarily of kin. From this sprung the Malayan system of relationship, in which all blood-relations fall under the heads either of parent and child, of grandparent and grandchild, or of brother and sister. Besides these, the relations by marriage were also recognized. In course of time a second system of relationship grew up, the Turanian, and the form found on this continent, to which he has given the name of the Ganowanian. This second system was based upon Punaluan marriage, accompanied by a division of the tribe into gentes. The gens comprised all those who have sprung from the same mother, and intermarriage in it was prohibited. The Turanian system of relationship included, in addition to the terms used in the Malayan, also words for uncle, aunt, nephew, niece, and cousin; and it recognized also the connections by marriage. The Malayan and the Turanian systems are called by Morgan classificatory, as distinguished from that in use among ourselves, which he calls the descriptive system.

Mr. McLennan, on the other hand, in his 'Primitive marriage,' criticised this view of the origin of the classificatory systems very severely as 'utterly unscientific,' and argued that such a system cannot be one of blood-ties at all, but that it is merely a mode of addressing persons. In it the terms 'son' and 'daughter' do not imply descent from the same mother or father, and the relationship of the child to its mother is completely ignored. The phenomena presented by such a system he undertook to explain as having originated from what he believed to be the oldest form of marriage, that of Nair polyandry, by which several unrelated men have a wife in common. This custom arose from the practice, in the earliest times, of female infanticide on account of the difficulty of subsistence. Thus a scarcity of women was occasioned, from which originated the general habit of procuring wives by capture from neighboring hostile tribes. From this custom sprung the usage of exogamy, by which intermarriage within the tribe was prohibited. Under Nair polyandry the only idea of blood-relationship conceivable would be through females, as the uncertainty of fatherhood would prevent the acknowledgment of kinship through males. Gradually there was developed a higher form of polyandry, the Thibetan, by which several brothers have a wife in common. The recognition of kinship through males having thus become possible, an explanation of the terms used in the classificatory system is not far to seek.

To this criticism and explanation Mr. Morgan replied by denying the general prevalence of either Nair or Thibetan polygamy, or of exogamy as a tribal custom, which he insisted was restricted to the gentes within the tribe. He argued, that, in the archaic form of the gens, descent was limited to the female line, and that this is what is really meant by McLennan's 'kinship through females only;' and he insisted that McLennan's hypothesis is utterly insufficient to account for the origin of the classificatory system, while ridiculing the idea that this could be a system of addresses instead of a system of consanguinity and affinity.

The discussion was now taken up by Messrs. Fison and Howitt in 'Kamilaroi and Kurnai,' a work upon the organization and primitive marriage customs of certain Australian tribes, and in a review of 'Primitive marriage' by Mr. Fison, in the *Popular science monthly* for June, 1880; in both of which Morgan's views were stoutly and elaborately maintained.

Shortly after, Mr. John McLennan having died, his brother Donald continued the discussion, on his side, by a review of 'Kamilaroi and Kurnai' in *Nature*, April 21, 1881, in which he attempted to refute Mr. Fison's objections to his brother's opin-

ions, and endeavored to prove that the former's views were based upon incorrect information. The argument was continued by his publication last year of a supplementary volume, based upon his late brother's papers, entitled 'The patriarchal theory,' written in opposition to the views upon this subject of Sir Henry Maine. In the preface he states that his brother had intended to present in greater detail the proofs of his theory of the origin of exogamy. He believed that it grew out of the system called 'totemism,' which had been outlined by him in three essays on 'The worship of animals and plants,' published in the *Fortnightly review* in 1869–70. From totemism came exogamy, arising from the scarcity of women; and this must have originated in societies acknowledging no kinship except through women. From this condition there has been a gradual progress by evolution, with varying degrees of rapidity among different people, but involving the recognition of kinship through males. As bearing upon the question of the scarcity of women, the late Mr. McLennan had already made a large collection of instances of the prevalence of infanticide and kindred practices.

Such being the present state of the controversy, as we said at the outset, the volume now before us, upon 'Kinship and marriage in early Arabia,' must be regarded as the last contribution to it. It upholds in the most uncompromising fashion the McLennan side. The learned author of the celebrated lectures upon 'The Old Testament and the Jewish Church' and upon 'The prophets of Israel,' in the discharge of his duties as lord-almoner's professor of Arabic in the University of Cambridge, had occasion to study thoroughly the laws of marriage and of tribal organization which prevailed in Arabia at the time of Mohammed. He became fully satisfied that the system of male kinship there had been preceded by one of kinship through women only, and that changes in the tribal system went hand in hand with the change in the system of kinship. He is also convinced that the correspondence of the Arabian facts with this general theory proves that the system of totemism and the law of exogamy once prevailed among the Arabs, and that the general principles of the hypothesis laid down by McLennan in 'Primitive marriage' cannot be shaken. The results thus derived he believes have "a very important bearing on the most fundamental problems of Arabian history, and on the genesis of Islam itself." All who are interested in the history of the early institutions of mankind must welcome such a learned and novel explanation of the primitive type of Semitic religion, and of the consequences that have flowed from it.

The opinion has generally prevailed that the deities of the primitive tribes must be identified with the heavenly bodies; but our author proves that this was not the earliest form of tribal religion. The Arabs retained a tribal constitution longer than the other Semites, and we know much more about it than about that of any other tribe. In its primitive form it was a totem tribe; that is, one in which the belief that all its members are of one blood was associated with the religious conviction that the life of the tribe was in some mysterious way derived from some animal or plant. "There is reason to think," he remarks, "that in early times totem tribesmen generally bore on their bodies a mark of their totem, and that this is the true explanation not only of tattooing, but of the many strange deformations of the teeth, skull, and the like, which savages inflict on themselves and their children" (p. 187). So he would explain the 'mark' set on Cain by Jehovah as "the tribal mark, which every man bore on his person, and without which the ancient form of blood-feud, as the affair of the whole stock, however scattered, and not of near relatives alone, could hardly have been worked" (p. 216). The most important evidence of the feeling, involved in the totem religion, that a man's totem animal is of one race with himself, is derived from the doctrine of forbidden foods. "A prohibition to eat the flesh of an animal of a certain species, that has its ground, not in natural loathing, but in religious horror and reverence, implies that something divine is ascribed to every animal of the species. And what seems to us to be natural loathing often turns out, in the case of primitive peoples, to be based on a religious *taboo*, and to have its origin, not in feelings of contemptuous disgust, but of reverential dread. . . . Unclean animals, whom it was pollution to eat, were simply holy animals" (p. 307). Many of their most ancient tribal names are taken from animals, of which our author gives an explanatory list of more than thirty. Such names the genealogists usually seek to explain as derived from an eponymous ancestor. But the history of paternity among the Arabs makes it clear that ancient stock-names were not derived from fathers; for the system of stocks was in existence, and they must have had names, long before the idea of fatherhood had been developed.

Three forms of marriage were known among the Arabs in antiquity: *Mot'a marriage*, which was a temporary arrangement for a fixed time; *Beena marriage*, a development of the system of Nair polyandry, where the husband settled among the wife's kindred; and *Baal marriage*, which was probably unknown before the Semitic dispersion, in which the husband took the wife to his own home,

becoming her 'lord and master.' The first kind was common at the time of Mohammed, and was with difficulty, if at all, abolished by him. Under it, as well as under Beena marriage, kinship could have been reckoned only through females. Before Baal marriage was established, a kind of Thibetan polyandry had prevailed, which he calls Baal polyandry, in which the husbands were all of one stock. From this arose the habit of acknowledging kinship through males. This Baal polyandry had grown out of the custom of marriage by capture, which was older than that of marriage by purchase, and continued after the latter custom had sprung up. In Baal marriage, of course, whether constituted by capture or by contract, the children would be regarded as belonging to the blood of the father.

We regret that we cannot allude to many other important subjects, especially that of the prohibited degrees, from which useful light may be derived upon the problems of early kinship, as well as to numerous excursuses in the notes upon interesting archeological topics. We can only refer general students of early society, as well as all who are interested in old Arabia, to this valuable work, which, having been expanded and rewritten from a course of university lectures delivered in 1885, contains the last word in the important controversy of which we have attempted to sketch the outline. H. W. H.

THE OIL-WELLS OF BAKU.

BAKU is a seaport town of the Apsheron peninsula, in the Caspian Sea, in the most southern part of the Russian territory. The adjacent region has long attracted the attention of the surrounding nations, on account of the naphtha with which the soil is impregnated. The inflammable gases issuing from the ground rendered the locality sacred in the eyes of the Parsees, or fire-worshippers, who have long resorted to it from distant places. The peninsula is an arid waste; and one of the most serious difficulties encountered is the scarcity of water, both for mechanical and dietetic uses. The centre of the oil-industry, according to F. Vasilieff, as given in the Proceedings of the Institution of civil engineers, does not exceed four and a half square miles in area, which forms, indeed, the centre of the whole oil-bearing region of the Caucasus.

The earliest oil-wells date back for centuries. A Persian inscription has been found which fixes the date of one of them at 1594. After the cession of the country to the Russians in 1813, the oil-industry was under the control of the government, and up to 1873 the entire revenue derived from this source did not exceed fifty thousand dollars. The manufacture of kerosene commenced in 1858, after which the industry began to develop slowly; but within the last fifteen years it has increased with greater activity. At that time land was sold at auction, and brought as high as five thousand dollars per acre. The old crude methods and shallow wells were abandoned, and at present there are more than five hundred borings. The yield has now reached a million tons per annum.

The naphtha-bearing strata, three of which are so far known, belong to the lower miocene formation. They dip at an angle of from 20° to 40°, and are composed of sand, calcareous clays, marls, and in places compact sandstone, often of great thickness. Organic remains are wholly absent. The naphtha-bearing sands are in a semi-fluid condition, and, when brought to the surface, give off carburetted-hydrogen gas. Not only do these sands give much trouble, but the salt water associated with them makes the driving of bore-wells difficult.

The plateau is a hundred and forty feet above the surface of the Caspian Sea, and the bores reach as deep as six or seven hundred feet. The depth, however, depends upon the yield and the quality of the oil. At first the oil does not reach high in the borings; but, as the depth increases, it rises, and at last is forced out by the pent-up gases.

A naphtha-fountain differs very much from one of water. The oil, on leaving the pipe, is broken up into many jets, which scatter in all directions. The larger part, on account of the liberation of the occluded gases, is shattered into the finest spray. Together with the oil, there is ejected an immense quantity of sand, stones, lumps of clay, some of the pieces being very large. This condition of things is explained by the high pressure of the gases, which has been measured in closed bore-pipes, and found to range between fifty and three hundred pounds per square inch. In the year 1883 two fountains played simultaneously to a height of between two hundred and fifty and three hundred and fifty feet. When a fountain breaks out, the boarding of the boring-turret is soon torn off, stones are thrown up to a great height, and it is dangerous to approach the bore, especially from the circumstance that the naphtha spray has an inebriating effect on the workmen. A cloud of naphtha hovers over the fountain, and is carried to great distances by the winds, covering every thing it passes over with a light film of oil. The sand thrown up forms a hillock round the well, often rising to twenty-eight feet in height. The bursting-forth of a fountain is accompanied by loud noises and a trembling of the earth. Millions

of tons of oil have been lost from an inability to direct it into reservoirs, which are frequently not even prepared before the need of them arises. Some fountains are intermittent, and play from one to two or three hours at a time, and then cease for a day or so. These are the most convenient, as they give plenty of time to arrange for collecting the oil. In some cases the action has to be started by withdrawing a few scoops of oil from the bore, and thus disturbing the subterranean equilibrium.

Continuous fountains sooner or later become intermittent, and then, like the latter, settle down into ordinary wells, from which the oil must be raised by the usual methods. The jet sent out of a bore-pipe appears urged forward by a rapid succession of pulsations; but periods of quiet may be noted, during which the fountain seems to gather up its strength for an extra energetic effort. The height of the jet varies with the intensity of the pulsations. A continuous fountain may yield over thirty-three hundred tons of oil, and require the labor of a hundred men to collect and store it in reservoirs. The daily yield would be worth five hundred dollars, the cost of labor being from seventy-five to a hundred dollars.

The condition of the oil is such, that, when no longer forced out by internal agencies, it must be removed from the bores by means of scoops: hence the bore-holes have to be large, usually sixteen inches in diameter, and, having to be maintained at that diameter throughout, must be lined with bore-pipes. The cost of these bore-pipes is a serious item, in a well of six hundred feet in depth costing twenty-five hundred dollars, while the expense of sinking the bore amounts to about five thousand dollars.

The owners of allotments are free to sink their bore-holes where they like: hence they are mostly sunk along the boundaries of the plots, and not at the points which the lay of the strata would indicate to be the most advantageous. The reason for this is, that each proprietor considers, that by sinking a bore near his neighbor's plot, if he succeed, he will get his own oil and a good deal of his neighbor's also. His neighbor is actuated by the same motives: hence the allotments have the appearance of fortified places, being surrounded by works, and unoccupied over the greater portion of their inner areas. Naturally, if a bore be exceptionally successful, a large number of additional ones are at once driven, and the yield of each is in consequence reduced.

The mean produce of the one hundred wells now in action is given at thirty-two tons per well per day, from March to November. The average cost of production is about twelve dollars per ton, nearly five per cent of which is due to the scarcity of water.

A commission appointed by the government reports that a pipe-line from Baku to Batoum on the Black Sea is indispensable for the higher development of this industry, as at present not one-half of the valuable products are obtainable. The commission, however, thinks that the undertaking should be left to private enterprise. The Transcaucasian railway will in a measure aid in the transportation.

RATIO OF INCREASE OF HEIGHT TO INCREASE OF BULK IN THE CHILD.

SOME remarkable observations, we learn from the *Lancet*, have been recently made by the Rev. Malling Hansen, principal of the Danish institution for the deaf and dumb, on the progressive increase in height and weight of children, one hundred and thirty of whom were under his charge. Of these, seventy-two were boys and fifty-eight girls, and they were weighed in batches of twenty, four times daily, — in the morning, before dinner, after dinner, and at bed-time. Each child was measured once a day. The weighings and measurements extended over a period of three years, and the results showed that the increase in the bulk and height of the body does not proceed at a uniform rate throughout the year. Three distinct periods, with some minor variations, were observed. In regard to bulk, the maximum period extends from August until December; the period of equipoise lasts from December until about the middle of April; and then follows the minimum period until August. In regard to height, the maximum period corresponds to the minimum period of increase in bulk. In September and October a child grows only a fifth of what it did in June and July. So it appears that during the autumn and the beginning of winter the child accumulates bulk, but the height is stationary. In the early summer, on the other hand, the bulk remains nearly unchanged, but the vital force and nourishment are expended to the benefit of height. When the body works for bulk, there is rest for growth, and *vice versa*. Mr. Hansen has observed a similar ratio of increase of bulk to increase of height in trees. In regard to the minor variations observed, it is probable that they are dependent, in part at least, upon the external temperature; so that, when this runs up, there is marked increase in weight, while a diminution of weight occurs with a fall of temperature.

Mr. Hansen's observations are undoubtedly of considerable importance. Similar ones have been

made by Dr. W. R. Miller, surgeon to the West Riding convict prison. Dr. Miller experimented on about four thousand prisoners for thirteen years, and obtained results that differ sensibly from those of Mr. Hansen; for he found that the season of maximum increase in weight in adults is from April to August, and the period of minimum increase in adults from September to March. Dr. Miller found the body became heavier in summer, and lighter in winter; and he attributes the loss of weight to the more active excretion of carbonic-acid gas in the colder months.

DIFFERENT PHYSIOLOGICAL SENSES FOR HEAT AND COLD.

IN connection with the researches of Professor Hall and Dr. Donaldson of Johns Hopkins university, recently given in *Mind*, it will be of interest to state that Mr. A. Herzen has lately published in the *Archiv für physiologie*[1] the results of a series of experiments showing that the physiological sense of cold is different from that of heat. His attention was first directed to the subject by a simple incident, the verification of which may be readily made by any observer. Awakening one night, he found one of his arms lying without the bed-clothes, 'alseep;' in touching it with the other hand, he perceived a distinct sensibility to warmth, while that of touch was gone. Bringing his arm, however, in contact with cold substances, he was surprised to find no sensation.

Pursuing the subject further, he produced artificially this condition of semi-paralysis by the compression of nerve-trunks, and by experimentation discovered that the sensibility to cold remained a short time after tactile impressions had disappeared, and that the sensibility to warmth remained much longer, but not quite as long as the power of detecting pain; also that the impressions of warmth require more time for transmission to the brain than those of cold, bearing, in fact, the same relations to each other as the sense of pain does to that of cold. These results were further supplemented by observations on a person with complete and permanent tactile anaesthesia of the legs, but in whom the sense of pain remained normal. The subject was able to distinguish quite well the differences in temperature between 150° F. and 81° F., which was the normal temperature of the surface of the leg. Below the latter temperature, however, no sensation was produced, not even by the contact of ice on the inner side of the thigh. Other cases showed the same peculiarities, in which, with the disappearance of tactile sensibility, the susceptibility to cold was also lost, while that to warmth yet remained.

Vivisection experiments upon cats and dogs lead the author to the following conclusions: 1. The so-called sense of heat and cold is composed in reality of two senses quite independent both anatomically and physiologically; 2. Observations on healthy and diseased subjects show that the sensations of heat and cold are transmitted through different nerves, by different routes, and to different brain-centres; 3. The gyrus sigmoideus contains the centre (or the centripetal branches leading thereto) of touch and cold perceptions; 4. These sense-perceptions are transmitted through the posterior columns of the spinal cord, while those of the senses of pain and warmth are conveyed through the gray substance.

Although the senses of cold and touch on the one hand, and heat and pain on the other, seem to be more nearly related, yet one cannot unite them, or consider the different perceptibilities of heat and cold mere modifications of those of touch and heat. The researches of Blix and others have demonstrated the existence of separated, isolated, irregularly distributed points upon the body, of which one may be only sensible to cold, another to warmth, and a third to touch. Doubtless most persons have noticed the different degrees of susceptibility of different parts of the body to heat and cold: the author points out striking examples of such.

[1] *Ueber die spaltung des temperatursinnes in zwei gesonderte sinne*, xxxviii. p. 93, December, 1885.

RAINFALL IN SOUTH AFRICA.[1]

LITTLE has been known until recently on the subject of rainfall in South Africa, taken broadly over the whole country, although observers have for many years been keeping records at isolated stations. There has been for many years a meteorological commission in existence at Cape Town; and in the report for 1883 an interesting table was published, giving the means, monthly and yearly, at all stations where records have been kept for at least five years, with the altitude above sea-level, and the latitude and longitude for each station.

From these data Mr. Tripp has prepared a map of South Africa, with the idea of showing the distribution of the total yearly rainfall. The curves divide the area into districts, where the mean yearly rainfall is—

(1) Under 5 inches.
(2) From 5 " to 10 inches.
(3) " 10 " " 20 "
(4) " 20 " " 30 "
(5) Above 30 "

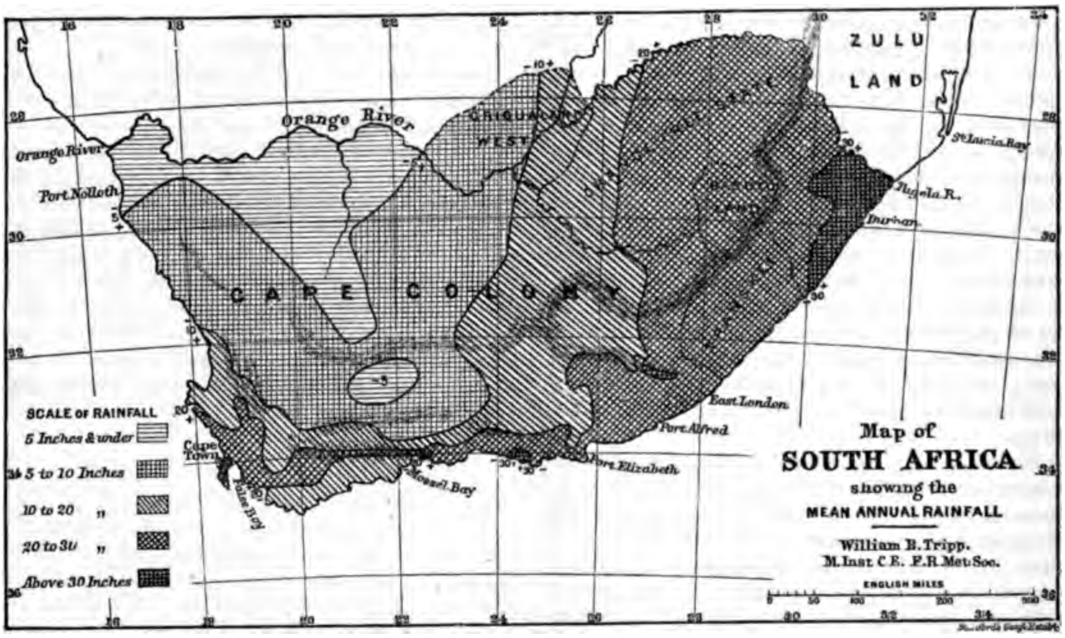
There are doubtless, particularly along the moun-

[1] Abstract of an article by William B. Tripp, in *Symons's meteorological magazine*.

tain ranges, many wet strips and spots where no definite records are kept, and which therefore cannot at present be shown on the map. Multiplication of records, as well as general local knowledge, will, no doubt, reveal many such places.

South Africa may be described as a central tableland, rising in successive terraces from the seacoast. The country has been subject to great erosion from water; and the mountains with which the country is studded, and the deep valleys, locally termed 'kloofs,' with which it is intersected, are principally due to this cause. In some cases the hills are covered with forests, but generally they are now denuded of such covering. Where the streams take their rise in an area denuded of forest, their volumes are highly variable, their beds being dry for, in some cases, three hundred days in the year; their only existence being, in fact, as torrents after sudden thunder-storms. When, however, it fortunately happens that the streams take their rise in an area still largely clothed with forests, they are frequently perennial.

The climate over such a large tract of country as South Africa varies, of course, considerably. The rainfall varies from 2 inches to 50 or 60 inches doubtless, and perhaps more in some of the mountain districts: in the north-west corner of Natal it is considerably over 30 inches. Dividing the country according to the half-yearly distribution of rainfall, we find that on the western and southern sides the fall is generally greater in the winter half of the year from April to September, than in the summer half from October to March; May, June, and July being the wettest months, and the north-west the general rain-bearing wind. On the eastern side, however, the fall is greater in the summer half, March and February being the wettest months, and the south-east the rain-bearing wind. On the south-east coast the dividing-line between these two different characteristics appears to run out to sea very nearly at Port Alfred, where the fall in both halves of the year appears to be very nearly identical, that in the summer half being rather the greater of the two.



Mr. Tripp resided and kept records for some years at King William's Town, in the eastern province, where, on a total of 283 days, from June, 1880, to May, 1883, 70 inches of rain were registered, 30.25 inches of which (recorded on 242 days) were made up of falls under 0.50 of an inch, 19.88 inches (on 28 days) from 0.50 of an inch to 1 inch, and 19.87 inches (on 13 days) of falls of from 1 inch or upwards, in twenty-four hours. The heaviest fall on any one day was 2.04 inches, and the next heaviest fall was 3.11 inches, in forty-eight hours.

Although this record proves that the rains are moderate and tolerably distributed, and do not all occur in sudden storms, yet the author has heard accounts of sudden falls there of a very different character, and most disastrous in their results.

FACSIMILE OF THE ANTILEGOMENA.

THE Johns Hopkins publication agency announces a reproduction in phototype of seventeen pages of a Syriac manuscript containing the epistles known as 'Antilegomena.' These are to be published under the editorial supervision of Prof. Isaac H. Hall, Ph.D., with brief descriptive notes by the editor. This manuscript consists of the Acts and Catholic epistles, and the Pauline epistles, followed by Hebrews; together with tables to find Easter, etc. (arranged for the Seleucid era), tables of ecclesiastical lessons, and a poem at the end, giving a history of the genesis of the manuscript. Its chief peculiarity consists in its containing seven Catholic epistles, while ordinary Syriac manuscripts have but three; 2 Peter, 2 and 3 John. and Jude being commonly rejected by the Syrians, and very rarely found among them. The version is Peshitto, except for these commonly rejected epistles, in which is followed the version usually printed. Each book, except the several Catholic epistles (and they as a whole), has its proemium from Gregory Bar Hebraeus, and its title and subscription. The manuscript is provided throughout with the Syrian sections and church lessons, and is dated at the end. Grammatical and other annotations occur frequently in the margins. The careful writing and pointing, as well as the superior character of the text, with the matters narrated in the poem at the end, show the work to be that of a critical Syrian scholar, and not of a mere copyist. Two notes by the contemporary corrector appear on leaves toward the end. The printed editions of the rejected epistles all rest on one inferior Bodleian manuscript, and particularly upon its *editio princeps*, published by Edward Pococke (Leyden, *Elzevir*) in 1630. This has hitherto been varied in later editions only by editorial conjecture. This is the second manuscript of these epistles ever given to the public, and doubles the available critical material, though a few other manuscripts of various ages are known to exist, some copied from the printed editions. The selected pages are: 1. A page containing the end of one of the tables of lessons, with a contemporary Arabic note respecting the origin and character of the manuscript; 2. The first page of Acts, with title and proemium, showing the general appearance and external characteristics of the manuscript: 3. The leaves which contain the Antilegomena matter, — 2 Peter, 2 and 3 John, and Jude (with them, of course, the end of 1 Peter, 1 John, and the beginning of Romans, with general proemium to the Pauline epistles and that to Romans); 4. The last page of the manuscript proper, end and subscription to Hebrews, and date of manuscript, with note of contemporary corrector; 5. Two pages containing the poem above referred to; in all, seventeen phototype pages, each on a separate leaf, besides additional pages containing appropriate descriptive and explanatory matter.

EDUCATIONAL BOOKS AND REPORTS.

A BATCH of educational pamphlets has been accumulating on our table, and we believe that a reference to their contents will be of interest to the readers of *Science*.

In the beautifully printed parchment series of Keagan Paul & Co., Lord Iddesleigh (Sir S. Northcote) has given a complete report of the entertaining lecture which he delivered as the first of a series of addresses to the students of the University of Edinburgh, Nov. 3, 1885. He discusses desultory reading, its pleasures, dangers, and uses. The theme is not new, but after Maurice, and Carlyle, and Lowell, and Emerson, and many more who have recorded their experience, these fresh statements on 'the friendship of books' are well worth reading. They suggested to the London *Spectator* of Jan. 2 a racy editorial, quite worth perusal.

The former cabinet-minister, Rt. Hon. G. J. Goschen, M.P., has collected seven of his addresses on educational and economical themes. That upon the cultivation of the imagination was reprinted long ago in Littell. The second, on mental training and useful knowledge, points out the danger of science-teaching; namely, that the teachers will endeavor to impart facts rather than to set the scholar thinking. The third, higher education for workingmen, is an explanation of the purposes of the London society for the extension of university teaching, and an endeavor to awaken a love of study among bread-winners. The lecture is most encouraging in its account of the success of popular concerts and lectures in London. The rest of the volume relates to economics.

The University of Cambridge has published the report of a syndicate on popular lectures, written by Rev. W. M. Ede of St. John's college. It reviews the work of the university extension scheme, and points out the obstacles which that work has encountered, and the danger of its degenerating into a mere lecturing scheme. The tone of the report is encouraging, and its frank exhibition of the conditions of failure and of success makes it suggestive to Americans who are endeavoring by like methods to carry instruction to those classes in the community who are at hard work during many hours each day.

This is the period when most of the reports ap-

pear which are given to the public on the part of universities and colleges. Among those which have reached us, that of Columbia college may first be named, which is dated as far back as May 5. President Barnard discusses the working of the elective system, and says that the study which has commanded the preference of the largest number in the classes where there is freedom of choice is Greek, while mathematics commands the preference of the smaller number. It should be borne in mind that this refers to the academical or classical department, not to the School of mines, where those young men are most likely to go who are adverse to Greek and inclined to mathematics. Of those electing, one-half elect French, one-third German, and one-seventh Spanish. The library, which a short time ago was forty-seventh in magnitude among collections in the United States, is now twentieth, and connected with it there is a school for the education of librarians. The School of mines, in its new accommodations, is more useful than ever, but the tendency to overwork is so strong that the faculty are considering important modifications of the courses.

President Walker, of the Massachusetts institute of technology, shows that the number of students has increased from 302 in 1881–82, to 609 in 1885–86, — a truly wonderful advance. They come from thirty-three states, and their average age is eighteen years and two months. He exhibits the value of the system of receiving young men as 'special students,' — a practice which elsewhere has led to inconveniences and difficulties.

In the University of Michigan, President Angell expresses regret that there are less students than formerly from homes without that state, and justly says that the institution will suffer if its cosmopolitan character is lost. He strongly commends the working of the elective system, and makes a vigorous, and we hope an irresistible, appeal for continued liberality in the development of the university.

The annual report of the University of California is prepared by the secretary of the regents, J. H. C. Bonté; and while it contains all the information which can be desired, and much more than is commonly given, it indicates the lack of a coordinating mind. The new president, Prof. E. S. Holden, entered upon his duties after the report was issued, and the result of his oversight will be seen a year hence. The report indicates great generosity in the endowment of the university. Its funds for general purposes amount to $1,678,-886, besides the site, the buildings, and certain property not yet available, estimated at more than a million of dollars. In addition to all this, there is the great Lick gift, for an observatory, and smaller endowments for medicine and law.

The full reports of Governor Stanford's gift indicate that his purposes are by no means so definite as were at first supposed, and it may be hoped that his mind is still open for suggestions which will tend toward important modifications in the original instrument.

Col. H. B. Sprague, late of Boston, has become president of Mills college for women, in California, and his inaugural address is a glowing review of the various subjects which tend to constitute a liberal education.

NEW BOOKS.

'HOUSEHOLD economy,' published under the direction of the Kitchen garden association (New York, *Ivison, Blakeman, Taylor & Co.*), is intended to supply a want long felt by almost every class of society, that of a clear, concise, and systematic text-book on those duties which "always have claimed, and probably always will claim, the main thought and time of the vast majority of women." —— 'Food-materials and their adulterations,' by Ellen H. Richards (Boston, *Estes & Lauriat*), is a little work intended for the intelligent housewife. The author disclaims novelty or originality. In some places the work is too technical for the readers whom the author would reach, and, as in the analysis of milk, some errors have slipped in; nevertheless the work will serve a very useful purpose, containing as it does a description of the principal food-materials and their adulterations, and at times hints on their culinary preparation. —— 'Nature's teaching,' by J. G. Wood (Boston, *Roberts*), is designed "to show the close connection between nature and human inventions, and that there is scarcely an invention of man that has not its prototype in nature." The author has there grouped a long series of parallels under the heads 'Nautical,' 'War and hunting,' 'Architecture,' 'Tools,' 'Optics,' 'Useful arts,' and 'Acoustics.' But often the merest resemblance of some natural growth to some human contrivance causes their association, when one has but the remotest connection with, or suggestiveness toward, the other. —— 'A handbook to the national museum at Washington' (New York, *Brentano brothers*) will be a useful guide to the extensive scientific collections of the national museum now on exhibition. It is interspersed with a large number of engravings, mostly good, which, together with the numerous explanatory notes, will give the work an independent value. It was prepared by Mr. Ernest Ingersoll, whose pleasant literary style is well known.

SCIENCE.

FRIDAY, FEBRUARY 19, 1886.

COMMENT AND CRITICISM.

MR. J. SCOTT KELTIE'S REPORT (Supplementary papers, Royal geographical society, part iv.), as inspector of geographical education, should be read by all who are interested in the cause of sound education. As to England, he says the situation of geographical education is best summed up in the words of an educational authority, whose name is not given: (1) "In universities it is *nil*; (2) in public schools, very nearly *nil*; and when it is attempted, it is given to the most incompetent master, and he has a wretched set of maps; (3) it is required for the public services, and taught, I do not know how, by crammers; (4) the only places where geography is systematically taught in England are the training colleges and the board-schools, with now, and for the last few years, some few good high and middle-class schools." This is due mainly to the fact that the study of geography does not 'pay.' There is no demand for high-grade teachers, as there are no professors or readers of geography in the universities. It has no real place in the examinations upon which so much depends in England, and therefore the teachers in some of the best schools actually advise their pupils not to study geography. How different in Germany, in France, and even in Spain! Considering the candid way in which the inspector has spoken of the English schools, it is perhaps fortunate that our worthy ex-commissioner of education was unable to furnish him with any information concerning the study of geography in American schools.

As a part of his duty, Mr. Kelsie made a collection of appliances used in geographical education throughout the world. These were placed on exhibition, and a catalogue issued. Here, again, the Germans led, as, indeed, one who has used Stanford's and Reimer's maps side by side in the class-room would have expected. In his explorations for such material, the inspector had many strange experiences; as, for instance, at one of the oldest and most celebrated English public schools he found only two maps, — "one a large map of the Dominion of Canada, presented by the high commissioner, ornamenting one of the passages; and another wretched school wall-map, exhumed, after much searching, from a remote recess." In contrast to this, he prints a list of the appliances used in teaching geography in the Frankfort Wöhlerschule, and in other German schools. In the above-named school there are in actual use one hundred and seven maps, pictures, models, and atlases. The exhibition was designed to illustrate the actual condition of things; "and, therefore, in all classes," according to Mr. Keltie, "will be found objects which may be taken as examples of 'how not to do it.'" Most of these were of English make. It is a curious commentary on our own methods, and especially on our publishers of educational works, that of the 305 maps, globes, models, relief-maps, etc., not one came from this side of the Atlantic. There were 163 atlases, but not a single atlas bore the imprint of an American publisher. Among the 229 text-books, only three — Miss Hale's 'Methods of teaching geography,' Hopkins's 'Handbook of the earth,' and Swinton's 'Complete course' — were of American manufacture. And on the whole the exhibition was not one of which either Englishmen or Americans should be proud.

SCIENCE AND THE STATE is the subject of a recent article by Dr. Shufeldt in *Mind in nature*, wherein he makes some very pertinent criticisms upon the heterogeneous condition of the national scientific work and the desirability of its greater unification. He proposes a scheme whereby this may be effected; viz., that a department of science should be created by congress, the head of which should be a cabinet officer, to be designated as the secretary of science, and to be chosen from the National academy of sciences; that this department should be divided into eleven bureaus,— agriculture, biology, chemistry, education, ethnology, geology, geodesy and surveying, meteorology, military and civil engineering, sanitary science, and industry; and that all appointments should be made by the National academy of sciences, and approved by the president of the United States. For the accommodation of

this department of science, he would have a large building erected, and liberal appropriations made. We doubt the entire feasibility of such a scheme. In the first place, to restrict the president in the choice of members of his cabinet to any given body of men, no matter how eminent that body may be, is simply out of the question; nor would this restriction be desirable. Members of the National academy are such because they are eminent specialists, and a specialist should be the last to control a department of this kind. Dr. Shufeldt also proposes, that commissioned army and navy officers who show scientific abilities should be encouraged and provided for by the government: this, too, has certain objections. Why the United States should hold out inducements to its commissioned officers to abandon the duties for which they were appointed, one cannot see. A surgeon or lieutenant of artillery has certain specific duties for which he enjoys a salary and future competency. By all means, he should be encouraged to excel in those duties, and he should not be discouraged in any other commendable work that he may undertake without detriment to them; but should government hold out direct reasons for him to become an archeologist, a philologist, a naturalist, or a physicist? Are army officers government wards, or government servants? and why should they have greater inducements to become Sanscrit scholars, chemists, and comparative anatomists, than the general public?

THE GREAT COST of elaborate printed catalogues, in which many of our wealthier libraries are now indulging, suggests the desirability of a scheme of co-operative cataloguing, which is stated at some length in this week's number of *The nation*, by Mr. Fletcher, the librarian at Amherst. He calls attention to the fact that nearly all our considerable libraries are making, or keeping up, elaborate catalogues, which are, to a large extent, repetitions of one another. As the suggestion of an experienced librarian, we incline to attach considerable significance to his saying that a very large share of the present cataloguing expense borne by these libraries is "wasted in the reduplication of that which ought to be done once for all. . . . Already this system of elaborate cataloguing, repeating itself in scores, even hundreds, of libraries, is breaking down of its own weight." Mr. Fletcher regards co-operation as furnishing the only solution of this important question, — a solution, too, "capable of meeting the needs of the twentieth century, when our libraries will be numbered by thousands, and the volumes in scores of them by millions. . . . The time must soon come when the libraries will no longer undertake to provide subject catalogues of their own. The author catalogues will necessarily be kept up, as each library must have a list of its books. But in place of the subject catalogues we shall have printed bibliographies of subjects, issued, for the most part, periodically, and serving equally for one library or another." These bibliographies may often indicate which libraries contain the rarer publications, on the plan admirably executed in Dr. Bolton's list of scientific periodicals, lately issued by the Smithsonian institution. Such a scheme of bibliographies and subject-indexes is unquestionably feasible, and Mr. Fletcher thinks it furnishes the only possible solution of the problem. It is to be hoped that the directors of our public and college libraries will show themselves ready to co-operate in whatever manner the co-operation committee of the American library association, of which Mr. Fletcher is the chairman, may decide upon. The committee invite any suggestions which may assist in forwarding the proposed reform.

THE LEADING SPIRITS of the theosophical society are evidently undismayed by the testimony against their honesty and candor, as adduced in the investigation carried on under the auspices of the English society for psychical research. A protest is now commenced against the conclusions of that investigation, prepared by A. P. Sinnett and Madame Blavatsky. The report of the psychical research society was noticed in *Science* (vol. vii. p. 81); and any effectual protest against conclusions so clear and decided as those of that report must be accompanied by the strongest evidence possible.

PROGRESS IN INDIA.

THE possibility of any national movement among the natives of India, looking toward state organization and self-government, has scarcely ever been accepted by her rulers and other civilized nations. Recent developments, however, seem to indicate that the Indian capacity has been underrated. A correspondent of the London *Times* states that the Bombay leaders have lately

given proof of their organizing power. They brought together a national congress composed of delegates from every political society of any importance throughout the country. Seventy-one members met together; twenty-nine great districts sent spokesmen. The whole of India was represented, from Madras to Lahore, from Bombay to Calcutta.

For the first time, perhaps, since the world began, India as a nation met together. Its congeries of races, its diversity of castes, all seemed to find common ground in their political aspirations. Only one great race was conspicuous by its absence; the Mohammedans of India were not there. They remained steadfast in their habitual separation. They certainly do not yield to either Hindoo or Parsee in their capacity for development, but they persistently refuse to act in common with the rest of the Indian subjects. Not only in their religion, but in their schools, and almost all their colleges, and all their daily life, they maintain an almost haughty reserve. The reason is not hard to find. They cannot forget that less than two centuries ago they were the dominant race, while their present rivals in progress only counted as so many millions of tax-paying units who contributed each his mite to swell the glory of Islam.

But in spite of the absence of the followers of the prophet, this was a great representative meeting. The delegates were mostly lawyers, schoolmasters, and newspaper editors, but there were some notable exceptions. Even supposing these three professions alone provided the delegates, the meeting would fairly represent the education and intellectual power of India. Not a word was said of social reform; all they discussed, and all they demanded, was political power and political changes; a tone of most absolute loyalty pervaded all the proceedings. Education and material prosperity, order, security, and good government, were all incidentally mentioned as causes of gratitude towards the present rulers. But such allusions were only by the way. Every desire was concentrated on political advancement and an immense increase of the share at present given to the natives of India in the government of their own country. The question of their ability to govern themselves was never even touched upon by the wisest of the speakers. Though there was much crude talk, much of that haste which only makes delay, and that ignorance which demands premature concessions, and too implicit reliance upon legislative powers, there was also much of most noble aspiration, and a sense of patriotism and national unity, which is a new departure in the races of the east.

PREJEVALSKY'S EXPLORATIONS IN MONGOLIA.

THE renowned traveller and explorer, Colonel Prejevalsky, to whom a reference is made in our St. Petersburg letter, arrived there on his return journey from Mongolia, the earlier part of the present month. A correspondent of the London *Times* says that this expedition of Colonel Prejevalsky, lasting two years, and costing over 43,000 roubles of government money, has been the most remarkable one ever undertaken in the wilds of Mongolia and Tibet. The intrepid explorer, as his published letters have already shown, literally fought his way into these inhospitable regions, at the head of a well-armed party of thirteen Cossacks, four grenadiers, and a host of other attendants; and, as he stated at Moscow, more than one hundred natives, who at different times waylaid the explorers, were made to feel the deadly effects of the Berdan rifle-fire. The exact numbers of the killed and wounded were stated in the extremely interesting letters addressed to the Grand Duke, at various stages of the journey. This is scientific exploration with a vengeance, and goes beyond any thing that Mr. Stanley did with his 'six-shooter' among the negroes of Africa.

In the last of the above-mentioned series of letters, the colonel also expressed the ardent wish of the Mongolian natives to be taken under Russian protection, and shielded from Chinese oppression. The same idea he has again impressed upon his friends, in answer to their many inquiries, as they greeted the tall, sun-burnt traveller. The *Viedomosti*, referring to this, says, "Among the natives visited by Colonel Prejevalsky there exists a deep conviction that sooner or later the 'great white czar' will enter their country and take them under his domination. At one place the explorer showed a portrait of the emperor to one of the natives, who went into raptures over it, and soon large crowds of inhabitants, with women and children from the neighboring districts, gathered round the colonel and implored him to show them the likeness of the 'white czar.'"

The regions visited by Colonel Prejevalsky are generally supposed to be, nominally at least, within the dominions of the emperor of China. No wonder, therefore, that rumors of a protest have come from Peking. The grenadiers who accompanied the expedition have been promoted, and, besides receiving pecuniary gratifications, have had their portraits distributed throughout the regiment. Colonel Prejevalsky has given a number of Russian names to newly-discovered places, such as the 'Moscow-Chain,' the 'Kremlin

Rock,' and the 'Czar-liberator's Mountain.' One hundred and fifty photographs and sketches were taken, and a large number of geological and other specimens were collected. The expedition will no doubt have important scientific, and perhaps other results.

THE U. S. GEOLOGICAL SURVEY.[1]

THE plan of this volume is the same as that of its predecessors, comprising, first, the summary report of the director; second, brief administrative reports of the chiefs of divisions on the work accomplished in the several departments of the survey, with brief itineraries of the field-parties; and, third, the accompanying papers, which make up the main part of the volume, and are the only feature of permanent interest or value. These papers are the monographs or final reports finished during the year. The longer monographs appear here in abstract form only, being, like the more fragmentary bulletins, published separately for the use of specialists. But, although the annual volume is not a perfect *résumé* of the survey, it is wisely designed to present all the results of interest to the general reader.

The principal feature of Major Powell's summary report for 1882–83 is the preliminary statement of the proposed topographical and geological map of the United States, with the accompanying map showing the, for the most part, very limited areas which have been surveyed under the authority of the various states and of the general government, on a scale suitable for the present purpose. The scale adopted for the proposed map is 1:250,000, or about four miles to the inch, with contour lines for every twenty-five to two hundred feet, according to the character of the topography. It is proposed to publish this general map in atlas sheets, each being composed of one degree of longitude by one of latitude, in areas bounded by parallels and meridians.

Although the administrative reports indicate a larger amount of topographic and geologic work than for any previous year, the published results are comparatively meagre, the monographic portion of this volume falling decidedly below the average in extent, if not in general interest. The most important paper has only an indirect relation to the geology of the United States. This is Captain Dutton's able memoir on the volcanoes of the Hawaiian Islands. This work was not done at the expense of the survey, nor in anticipation of the annexation of the island kingdom to this country, but simply as a preparation for the study of the gigantic lava-flows of the Cascade Range in northern California and Oregon, — a work upon which Captain Dutton has since been engaged. Hence criticism of the survey for extending its operations beyond its legitimate field is forestalled, and the publication of this valuable contribution to our knowledge of the noblest of living volcanoes will undoubtedly be justified by the light which it will throw upon the volcanic phenomena of our north-western territories; for, while these are unparalleled among the eruptions of historic times, the evident liquidity and the vast volume of the lava plainly suggest the stupendous flows of Hawaii as the proper preparatory field of the student who would bring to their investigation the best comparisons that modern volcanism affords.

It is impossible here to do justice to the graphic descriptive chapters, which fully sustain the reputation achieved by the author for the bold and discriminating portrayal of geologic phenomena, in his reports on the plateau country and the Grand Cañon. But the highly important and original chapter on the volcanic problem may not be disposed of so summarily. Captain Dutton has here gathered together the principal facts and conclusions reached in his study of Mauna Loa and Kilauea, with a view to ascertaining whether they shed any new light upon the dark problem of the volcano. He goes to the root of the matter at once by calling attention to the fact that the volcano is essentially a heat problem, and that the final solution to be sought is an explanation of the origin of this heat and its modes of action.

The universal postulate that the earth's interior is throughout in a state of incandescence is accepted as a matter of course; but the question as to whether it is mainly liquid or solid is regarded as still in abeyance, and the determination of this point is not considered essential to the discussion of the volcanic problem. Against the view that the penetration of water to the seat of the internal fires is the cause of volcanic action, two objections are urged. 1°. The access of cold water would cool, and probably solidify, the lava. It might be claimed on the other side, however, that the water must be itself very hot before it reaches the lava, and that aqueo-igneous liquefaction takes place at much lower temperatures than dry fusion. The vaporization of the water would, however, absorb a large amount of heat. 2°. But this last consideration is rendered unimportant by the second objection; viz., that liquid water cannot pass the isogeotherm of 772° F. (the temperature of its critical point), and hence must be vaporized long before it reaches the lava.

That aqueous vapor may penetrate to the reser-

[1] *Fourth annual report of the U. S. geological survey to the secretary of the interior* (1882–83). By J. W. POWELL. Washington, *Government*, 1884. 8°.

voirs of liquid rock and be absorbed by it, as any gas would be by a liquid, is regarded as entirely possible, and not improbable. But great emphasis is properly laid upon the fact that this gradual absorption of hot vapor by hot lava would not create any tendency in the lava to explode or erupt, unless accompanied by a diminution of pressure or increase of temperature; and it is demonstrated at considerable length that no changes of temperature or pressure in the magma, of sufficient magnitude to merit consideration, are possible: consequently the balance of probability is regarded as inclining decidedly against the hypothesis that water is the cause of volcanic action. It does not appear, however, that Captain Dutton has taken any account of the important consideration, that, by the rising of the isogeotherms, water-impregnated portions of the earth's crust may conceivably attain a high degree of liquidity and expansive force; i. e., be made eruptible.

The hypothesis that volcanic energy is due to the penetration of oxygen to the unoxidized earth-matter below the crust is also rejected, mainly because it appears to be insusceptible of proof or disproof, postulating conditions beyond the reach of argument, but partly on account of the difficulty of finding a sufficient amount of oxygen. The statement, however, that some naturalists *imagine* that the earth's interior is imperfectly oxidized is certainly unwarranted, in view of the fact that basic lavas contain metallic iron and a vast amount of iron in a low state of oxidation.

Mallet's theory, that volcanic heat results from the mechanical crushing of the rocks when the crust yields to the powerful horizontal pressure due to the cooling of the interior, and mountain-ranges, rock-folds, and faults are produced, shares the same fate; chiefly because it is now probable that the cooling of the earth has been up to this time comparatively superficial, the infra-crustal regions being still as hot as ever. But Captain Dutton's argument is not conclusive, since he has simply shown that the corrugation of the crust must be ascribed to some other cause, such as the diminution of the earth's oblateness in consequence of the retardation of its rotation by tidal friction. The corrugation itself is an unquestioned fact, and, however produced, must have been attended by an enormous development of heat.

The fourth hypothesis examined assumes a local development of heat in the earth by unknown causes. This cuts the Gordian knot instead of untying it, but is rejected because its conditions preclude all discussions of its validity or adequacy. Relief of pressure would greatly promote the liquefaction and elastic expansion of lavas; but this is unconditionally rejected as a cause of eruptions, since denudation, the only cause of diminished pressure which Captain Dutton recognizes, cannot be correlated in its distribution with active volcanoes.

Having thus discredited all hypotheses of the origin of volcanic heat heretofore proposed, Captain Dutton advances no new view, but coolly demolishes our hope with the statement that Mauna Loa and Kilauea do not throw any more light upon the general problem than other volcanoes. He proceeds to show, however, that in other directions they have contributed something to our knowledge of volcanism. They are at once the largest and most active of volcanoes, activity being measured by the outflow of lava, and dissipation of energy. They agree with active volcanoes in general in standing on an area of elevation. That Hawaii has risen nearly three thousand feet in comparatively recent times, is regarded as clearly proved by the elevated beaches and terraces. The problem of the causes of elevatory movements is then attacked, and the numerous hypotheses are reduced to two alternative propositions; viz., the elevated portion of the earth has experienced an increase of matter, or it has undergone expansion. While local increments of mass are not ignored, the expansion hypothesis is accepted as the one agreeing best with the observed facts; and the tangential thrusts of the earth's crust are definitively rejected as a primary cause of vertical movements. Our author wisely refrains, however, from estimating what proportion of the altitude of the Alps and other mountain-ranges is due to the crumpling of their strata; this crumpling being unquestionably due to horizontal thrusts, and amounting in the Alps, according to Heim, to seventy-four horizontal miles. Hawaii, we are told, floats high because of the lightness of this part of the earth's crust, its relatively low density being due in part to its high temperature, and in part to the porosity of the lava, and the numerous and often large tunnels by which the entire island appears to be honeycombed. But no calculation is given of the increase of temperature required in a thin crust, with a reasonable coefficient of expansion, to produce an elevation of two or three miles in a non-volcanic region. It is not easy to see how the expansion hypothesis can survive application to really important instances of elevation.

Captain Dutton regards the Hawaiian volcanoes as immense columns of liquid lava with their accumulated overflows; and the upper ends of these columns, whether frozen over or exposing fiery lakes to the sky, are believed to be fundamentally unlike the craters of ordinary volcanoes. The

term 'caldera' is proposed and used as a general name for volcanic orifices of the Hawaiian type. As the column of lava gradually melts away the enclosing rocks, the caldera is enlarged by the falling-in of the surface, and it is not in any case due to explosions. Mauna Loa and Kilauea are clearly independent volcanoes; and we have no reliable indications that their activity is diminishing. The vast antiquity of the Hawaiian volcanoes is plainly shown, not only by their magnitude, but also by the wonderful progress of the agents of erosion, especially in those islands where the volcanic fires are now extinct. This is one of the principal topics discussed in the chapters on Maui and Oahu.

The abstract of the report by Mr. J. S. Curtis on the mining geology of the Eureka district, Nevada, supplements that by Mr. Arnold Hague on the general geology of the same district in the preceding volume. It is accompanied by sections of the principal workings, and discusses exhaustively the characteristics and probable origin of these singular ore-deposits, which had yielded sixty millions of dollars up to the close of 1882.

Following this is a short but useful chapter on popular fallacies regarding precious metal ore-deposits by Mr. Albert Williams, jun. Dr. C. A. White's review of the Ostreidae of North America, with an appendix by Mr. Heilprin, and thirty-eight plates, describes in simple yet scientific language all the known fossil species and the single living species of the Atlantic coast. A second appendix by Mr. Ryder, with eleven plates, is devoted to an interesting sketch of the life-history of the oyster.

The volume concludes with Mr. I. C. Russell's geological reconnaissance in southern Oregon, with two maps and sixteen small sections. This is a short but highly interesting account of the extreme northern part of the Great Basin, which is shown to possess the same structural and climatic features as the basin of Lake Lahontan, which bounds it on the south, and was described by the author in the annual report for 1881–82.

GEOGRAPHICAL NOTES.

Missionary maps. — The establishments of Les missions catholiques at Lyon, France, have issued an atlas containing data collected by the Catholic missionaries in various parts of the world. Beside the general maps, which resemble those of any good elementary atlas, there are some thirty detailed maps which have appeared from time to time in the organ of the missionary bodies. Numerous important additions to geography have been made by the missionaries; and, in bringing them together in convenient form, the atlas meets a real need. They appeared first in German, with explanatory text by Father O. Werner, and have been translated into French, with additions, by Valerien Groffier.

A newly discovered affluent of the Kongo. — The despatches from the Cape of Good Hope state that the expedition under Lieutenant Wissmann has discovered a new affluent of the Kongo, which will have an important bearing on the opening-up of the lower Kongo basin. Wissmann is on his way to Europe with the details. The new river is a powerful stream, over five hundred miles in length, between the equator and Stanley Pool. It is eight miles wide at its mouth, and quite deep. There were no obstacles to its navigation and the Pogge Falls, in the Tapende country, latitude 6° south, and longitude 22° east. Lake Lincoln, to be found on some charts, does not exist: the only lake encountered was Lake Leopold II., near the Kongo. The journey was made in large canoes constructed by the expedition, and a way was forced through the territory of savage cannibal tribes, who, if armed with guns instead of arrows, would have prevented their passage. In a single day as many as five conflicts took place, and several of the party were wounded, though none were killed. The journey was accomplished by Lieutenants Wissmann and Müller, a physician, artificer, and forty-six natives. The ferocity of the natives is accounted for by the fact that they had never seen white men or fire-arms. More details will soon be accessible. Meanwhile it seems more likely that the river is one of those which have been known only by report, rather than an entirely new discovery. The country is reported to be fertile, producing palm-oil, sugarcane, rice, and other tropical products.

Explorations in Central South America. — De Brettes sends a short note on his recent travels in the unexplored part of the southern district of the Gran Chaco, which began last March, and lasted forty-four days. He discovered a large salt lake (along which his party travelled nine days, and the west shore of which is estimated to be one hundred and thirteen miles long), also three rivers, running in a northerly direction, supposed to be tributaries of the Rio Vermejo. The south Chaco is flat, covered with thorns, mimosas, and tall herbage. The natives are hypocritical and cruel, and live in utter barbarism. After penetrating two hundred and twenty miles into the unknown region, the explorers were obliged by fever to retrace their steps to Corrientes. A new expedition was in contemplation.

Restoration of Lake Moeris. — The investigations of Mr. Cope Whitehouse in regard to the

site of the ancient Lake Moeris in Egypt have been so fruitful that the Egyptian government has taken the matter in hand, and it is believed, that, by a small expenditure, the surplus waters of Bahr Yussef can be directed into the now dry depression. Preliminary surveys are in progress to determine the practicability and expense of restoring a state of things very exactly described by Herodotus, Strabo, and Pliny, as having existed in past ages.

Ancient Arabic inscription in the Sahara.— Le Chatelier furnishes an account of what may prove to be an important inscription in an artificial cavern at Timissao, near the wells and on the right bank of the wady of the same name, in the Sahara. The wady, coming from the south, turns here toward the west. Its banks are of conglomerate, in two horizontal beds, separated by a bed of gray schist in vertical layers. These schists have been dug out for a distance of over two hundred feet, forming a sort of gallery fifteen feet wide and six or seven feet high. The inner wall of the gallery is occupied by an inscription in Tifinakh lettering, the characters incised, and painted with red ochre. A more modern inscription in Arabic is simply painted on the roof. At the further end are some archaic incised figures on the wall, including those of five horses. The accounts seem to be truthful, though derived from the natives; and, if so, the deciphering of the inscriptions would be of great interest.

ASTRONOMICAL NOTES.

Eclipse of the sun, 1886, Aug. 28–29.—A bill has been introduced in congress, by Mr. Thomas of Illinois, to enable the secretary of the navy to fit out an expedition to observe the total eclipse of the sun which occurs on the 29th of August next. The sum of ten thousand dollars is appropriated for defraying the expenses of the expedition; and the secretary is authorized to detail a naval vessel to transport the party to a point near Benguela, on the west coast of Africa, almost the only seaport which is near the central line of totality. The bill was introduced in the house of representatives on the 11th of January, but has not yet come up for consideration A similar bill introduced in the senate has been favorably reported by the committee on naval affairs. It will be remembered that this eclipse is of rather more than ordinary interest on account of the long duration of totality, — $4^m\ 41^s$ near Benguela. Another interesting circumstance has been noticed by Dr. Herz of Vienna, in the fact that at totality two stars, 47ρ Leonis and 49 Leonis, are close to the sun, the latter within the corona. It is suggested, that, by means of measurements upon these two stars, something may be learned in regard to the refracting power of this peculiar atmosphere of the sun. The total phase will be visible in the West Indies; but the sun will not be in a good position for observation. According to *Nature*, at Carriacou, the largest of the Grenadine Islands, totality commences at $19^h\ 11^m\ 45^s$ local mean time, and lasts $3^m\ 21^s$; the sun's altitude being 20°.

Comet 1886 . . . (*Barnard*). — According to an ephemeris published by Mr. H. V. Egbert of the Dudley observatory, we may look for this comet to become quite a bright object during the early morning-hours in the latter part of May. Mr. Egbert's calculation shows that the comet on the 20th of May will be 360 times as bright as it was when discovered by Mr. Barnard, Dec. 3. Its position will be R. A., $2^h\ 53^m$; decl., + 20° 26′; that is, it will appear above our horizon about an hour before the sun.

ST. PETERSBURG LETTER.

The last number (9) of the Journal of the Russian physico-chemical society contains an elaborate paper, by K. Kraewitch, on the relation between the elasticity and density of the air in a rarified condition. His experiments on the velocity of sound show, that at a temperature of 17.5° C., the velocity decreased from 330 metres, at a pressure of 761 millimetres, to 171 metres, at a pressure of 2.6 millimetres. At a pressure of 280 millimetres, the velocity is about the same as the mean air pressure; but it diminishes rapidly below 280 millimetres. He concluded that gases below this pressure do not obey the Boyle-Mariotte law.

At the general meeting of the physico-chemical society in December, the coming eclipse of Aug. 18, 1887, was discussed. Prof. S. P. Glasenap showed a map on which the path of the total eclipse was marked. As it traverses an immense extent of Russia from Kiev to south-eastern Transbaikalia, and appears also on the shores of the great ocean at Possiet harbor, and as a total eclipse will not appear in Russia for thirty-six years after 1887, he concluded that the best use should be made of the opportunities offered by the eclipse to study different problems relating to solar physics. Prof. N. G. Egoroff followed with a communication on the corona and the opportunities offered by the eclipse for its study. The last paper was by Prof. A. Woeikof, on the meteorological side of the question. Observations on the amount of cloud prevalent in the region show a cloudiness of about 51; that is, half the sky is

clouded on the average, from the western part of the totality to Lake Baikal, the region on both sides of the Ural Mountains excepted, where it is above 6. Probably the conditions will be a little better than those indicated, as the eclipse will take place in the later morning hours, when cloudiness is somewhat less than in early morning and the afternoon. In southern Transbaikalia the cloudiness is even less. There is no doubt, according to Woeikof, that, if the observing parties are well distributed on the path of the eclipse, some of them will certainly have good atmospherical conditions, it being impossible that the sky be everywhere overcast on so extensive a territory. The great interest of barometric observations during the eclipse was then dwelt on, and the subject illustrated by the results of the American expedition to the Caroline Islands. The results would be especially important as bearing on the theory of the daily variation of air pressure.

At the annual meeting of the Academy of sciences, Jan. 10, the most interesting feature was a report on the progress and future prospects of the expedition to the New Siberian Islands under Dr. Bunge. It was to begin with an exploration of the Yana Basin. Among other matters, some results of last year's observations at Werkhojansk were mentioned. The mean temperature of January, 1885, was $-52^{\circ}.7$ C. ($-62^{\circ}.9$ F.) and the minimum -68° C. ($-90^{\circ}.4$ F.). Thus the low mean winter temperature at this place is more than confirmed by new and reliable observations, and it has the coldest winter weather yet known on our globe.

Colonel Prejevalsky has not yet arrived at St. Petersburg. He is to lecture at Moscow to-day on his last travels.

The annual meeting of the geographical society was held to-day. It was principally devoted to a review of the year's work of the society by the secretary. The annual awards followed. The highest, the Constantine medal, was awarded to N. D. Jurgens, the chief of the Russian Lena expedition. The Lütke medal was awarded to Colonel Pewtsow for his extensive travels and explorations in Mongolia; the great medal of the section of statistics, to Terestchenko, for his statistical description of several districts of the government of Poltava; the great medal of the ethnographical section, to Dmitrowsky, for his translation, with numerous additions of Otono Kigoro's Japanese account of Korea. The small gold medals were awarded to W. N. Maĭnow, for his anthropological and ethnographical description of the Mordwa (a Finnish tribe of eastern European Russia); to W. Fuss, for the calculation of the results of the Siberian levelling; to Prof. R. E. Lenz, for his useful work as president of the section of physical geography for seven years; and to Mielberg, for magnetical observation at Tiflis in connection with the polar stations.

The next number of the Iswestia of the society will contain an important work of Gen. A. A. Tillo on the level of Lakes Ladoga, Husen, and Onega. In round numbers, the first was found to be five metres, the second eighteen, the last thirty-five metres, above the mean level of the Gulf of Finland. This is considerably less than admitted till now. For the altitude of Lake Ladoga, a height of about twenty metres was generally received; and for Onega, seventy metres.

When the results of the levelling of Lake Ladoga were first calculated, they were received with distrust, and a levelling on another road was made; but the result was confirmed. Other levellings are begun by the Ministry of public works, under the direction of General Tillo, among others, on the upper Volga. The general result is to make the level of the waters lower than they were admitted to be till now.

A movement is under way for establishing a female medical school at St. Petersburg. A few years ago, ladies received instruction at one of the military hospitals, and some of the graduates are practising with honor. Later this instruction ceased, as the minister of war would not continue the subsidy given before, nor allow the use of the buildings. Now the matter is under discussion in the duma (city assembly) of St. Petersburg. There are also private subscriptions for this end, and lately the great importance of female physicans is especially insisted upon for central Asia and eastern Transcaucasia; that is, provinces where the great mass of the people are Mohammedans. O. E.

St. Petersburg, Jan. 17.

NOTES AND NEWS.

THE subject of bird-protection is receiving increased attention in England. A 'bird-protection league' has been organized through the instrumentality of Mr. G. A. Musgreave, F.R.G.S., the members of which pledge themselves neither to purchase birds of beautiful plumage nor to shoot rare birds.

— The council of the Practical naturalists' society of England have appointed Dr. J. W. Williams to make a survey of British bird-migration, and prepare a list of migratory species, including those rare and extinct.

— In connection with some letters which have recently appeared in these columns, the following sentences from Mr. Keltie's report will be of inter-

est: "Good large reliefs of limited areas, in which the two scales are as nearly as possible the same, are, in my opinion, of great service in geographical teaching: but relief-maps of large areas, constructed and colored as I have seen some of those much advertised in this country [England] by unskilled mechanics, in which the scale of altitude is indefinitely magnified, are exceedingly mischievous."

— The valuable collections of mesozoic and czenozoic invertebrate paleontology, in the possession of the national museum, have been arranged for reference and study. They consist of the material obtained by all of the earlier explorations of the west, and the various geological surveys, as well as the numerous contributions to the Smithsonian institution. Heretofore these collections have been practically inaccessible, owing to their deranged condition. Over fifteen hundred figured types are included in this material; and a preliminary catalogue has already been issued.

— Bulletin 31 of the national museum, Monograph of the Syrphidae, by Dr. Williston of New Haven, will shortly be issued.

— The recent purchase of new quarters for the Cosmos club of Washington has had a marked effect on the number of applicants for membership. The quota of members composing the club (250) will be speedily filled.

— Of the three colleges — Columbia, Harvard, and University of Pennsylvania — that received the benefit of the Tyndall fund, Columbia has been the first to act. Her trustees have recently drawn up a series of regulations in regard to the John Tyndall fellowship. The fellow, who is to be appointed on the recommendation of the president and professors in the scientific department, must pursue a course of study and research in experimental physics for the term of one year, and he may be re-appointed. The first incumbent of the fellowship is Michael Pupin, who graduated at Columbia in 1883 with honors, and has since his graduation been studying mathematics and physics at Cambridge, England.

— The fish commission will publish a census of the fisheries of the great lakes; and a corps of clerks is now busily engaged in preparing the tabulated statements of the results of the investigations made last year. The commission is also trying to institute a more systematic method of recording the statistics of the sea-fisheries, and, in co-operation with the treasury department, has issued circulars to collectors of customs at various ports, requesting them to obtain from the masters of fishing-vessels facts and figures concerning the sea-fisheries in which they are engaged.

— Mr. Charles A. Ashburner, geologist in charge of the Pennsylvania survey, has been invited to deliver a lecture on the geology and mining of petroleum and natural gas before the engineering society at Columbia School of mines, Friday, Feb. 26. The lecture will be illustrated by maps, charts, and lantern-slides, and will embody the results of the state survey up to date.

— The U. S. hydrographic office issues a weekly supplement to the monthly pilot chart of the North Atlantic ocean, which will be of special value to coasters. It contains accounts of every obstruction and danger along the coast, and other matters of interest to seamen, relating to navigation, such as changes in lights or buoys. These bulletins are posted in all the seaport cities; and the maritime community is invited to send any information of value to the central office at Washington, or to any of the branch offices at Boston, New York, Philadelphia, Baltimore, New Orleans, and San Francisco. The object of the hydrographic office is to place within reach of sailors, at no expense to them, such information as cannot be collected profitably by an individual, but which the government can readily gather, at no additional cost, through agencies already established.

— The preparation and preservation of anatomical specimens have always been more or less unsatisfactory in museum collections. The U. S. army and medical museum has recently, under the supervision of Dr. J. S. Billings, instituted a number of important improvements in these respects. Frozen sections, made of bodies with the organs in natural relation — a method practised in Europe for a number of years — are placed in special dishes or bowls, resembling ordinary wash-bowls with the top ground off, attached to a colored background of plaster-of-Paris. A glass cover is then cemented over the bowl, and through a small aperture the space is filled quite full with the preservative fluid. The colors of the tissues are preserved nearly as in life, by special means, and the whole preparation gives a naturalness not possible of attainment by any other method. Another feature, which has been devised at the museum, is a series of sections of the typical crania of the vertebrated animals. The object of this collection is to show the relationship of the bones which enter into the formation of the skull. These sections are made in a longitudinal-vertical direction, and the corresponding bones are painted the same color. Thus, in the series presented, the student can determine at a glance the relative state of development of any particular bone, from

that of a fish to that of a human being. The sections are then mounted, one set displaying the structure of the internal part of the cranium, the other representing the bones as they appear from the outside.

— The 'Geological railway guide' that was in course of revision for an enlarged second edition by the late James Macfarlane at the time of his death, is now in the hands of his son, James R. Macfarlane, 100 Diamond Street, Pittsburgh, Penn., who will edit and publish the work at an early date. Judging by the sample sheet, from which extracts were given in *Science* some months ago, the new edition will give a large amount of information directly useful to the travelling geologist, and will be a fitting memorial of its projector.

— In a discussion of the temperature of Munich by Erk, in the annual volume containing the observations of the Bavarian meteorological stations, the corrections are computed to reduce the mean of certain ordinary hours of observation to the true mean of the day. For the mean of 7.2 and twice 9, the reduction is $-0°.02$ C., varying from $+0°.14$ in October, to $-0°.16$ in May and July; for 8.2 and twice 10, it is $-0°.06$, varying from $+0°.04$ in October, to $-0°.17$ in April and May; for the mean of maximum and minimum it is $-0°.08$, varying from $0°.00$ in December, to $-0°.30$ in October. Similar corrections have been made for a few places in this country. Additional ones are needed for many more stations, on account of the considerable diversity of hours of observation still prevailing among amateur meteorologists, on whom much of the knowledge of our climatology depends.

— Mr. Alfred Russel Wallace, the eminent naturalist, says the Boston *Beacon*, is quietly planning an early visit to this country. He intends to pass some time in California, but may possibly accept a few invitations to lecture.

— The *Geographisches jahrbuch* has just published interesting statistics in regard to the societies and publications devoted to geographical research. Those who have not been especially interested in these studies will be surprised to learn that there now exist, throughout the world, ninety-four active geographical societies, with a membership of nearly fifty thousand. This does not include fifty-eight societies in which geographical researches are subordinated to others. The entire income of these societies amounts to more than a quarter of million dollars annually, most of which is spent in the publication of transactions or in the furtherance of explorations. Of these ninety-four societies, France has twenty-six, with a membership of eighteen thousand; Germany, twenty-four, with nine thousand members; Italy and Switzerland, six each, with three thousand members; Great Britain and her colonies, five, with five thousand members and an income of nearly seventy-five thousand dollars; the United States, two, with fifteen hundred members. A hundred and twenty-six periodicals are devoted to geography, of which forty-two are published in French: thirty-eight in German; eight in Russian; seven in Italian; six each in English, Spanish, and Portuguese; and one each in Danish, Hungarian, Swedish, Roumanian, and Japanese.

— The French academy, says the *Révue botanique*, has recently announced the discovery of the entire efficacy of sulphate of copper in the destruction of Peronospora viticola, the American fungus or mildew of vines, the great scourge of vineyards over large areas of the United States.

— The Manchester philosophical and literary society possesses, says the *Chemical news*, a microscopic slide containing the Lord's prayer, written within the space of the four-hundred-and-five-thousandth part of an inch. To find this minute speck requires the exercise of much patience, as it is not only necessary to have just the right kind of illumination, but the focus of the lens must be on the true surface of the glass on which the object is written. When once seen with a low power, it is not difficult to find with the same power; but with the half-inch and higher powers it is always a trial of patience, even when the position of the object has been carefully registered with a lower power, and you are sure that the object is central in the field. Perhaps with the achromatic condenser some of the difficulty may be removed. This wonderfully minute object was written, or rather engraved, by Mr. Webb, years ago, by the aid of an instrument now in the possession of the society. Webb was accustomed to write the Lord's prayer in spaces of the five-hundredth to the ten-thousandth of an inch, and, as has been seen, to the four-hundred-and-five-thousandth.

— A writer in a late number of *Ciel et terre* states, that under the most favorable conditions, from the summit of the Dôle (altitude, 1,678 metres), all the summits of the Alps are easily visible, from that of Pelvoux (4,000 metres), seventy-eight miles to the south, to the peak of Säntis (2,504 metres), clearly outlined in white against the deep blue of the horizon, one hundred and three miles distant. The view thus embraces all the peaks of the chain of the Alps for an extent of more than one hundred and fifty miles. Contrary to that which has been observed in

lower altitudes, the writer asserts that the time is generally more favorable for vision in the afternoon, and that it is at sunset that one obtains the best views in the Alps.

—The geographical society of Lisbon has recently published a list of the journals in the Portuguese provinces, printed in that language. This list includes the names of nineteen in Angola, six at Cape Verde, seven in China, two in Guinea, fifteen in English India, seventy-two in Portuguese India, seventeen in Macao and Timor, ten in Mozambique, and three in the island of St. Thomas. In addition, seventeen are published in Portugal, which are devoted to the interests of the foreign Portuguese provinces.

—Interesting experiments have lately been made by Dr. Parsons, we learn from *Health*, on disinfection of clothes and bedding by heat. These experiments, among other points, have shown what degree of heat, and duration of exposure, are necessary under different conditions (e.g., of moisture and dryness) in order to destroy with certainty the germs of infectious disease. The net results of Dr. Parsons's experiments on this head are as follows: with the exception of spore-bearing cultivations of the bacillus of splenic-fever, all the infective materials reported on were destroyed by an hour's exposure to dry heat of 220° F., or five minutes' exposure to steam at 212° F. Spores (or the reproductive particles) of this bacillus required for destruction four hours' exposure to dry heat of 220° F., or one hour's exposure to dry heat of 245° F., but were destroyed by five minutes' exposure to a heat of 212° F. in steam or boiling water. It may therefore be assumed that the germs of the ordinary infectious diseases cannot withstand an exposure of an hour to dry heat of 220° F., or an exposure of five minutes to boiling water or steam of 212° F.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Did Dr. Hayes reach Cape Lieber in his arctic exploration of 1861?

THIS question has given rise to much controversy of late years; and, for the sake of truth, it is highly desirable that it should be satisfactorily answered, although this could only be definitely done by the discovery of the cairn, with its enclosed statement, deposited by Dr. Hayes at the highest latitude reached by him.

The writer believes he can throw some little light on the question, from the fact that he had the original records before him, worked up the astronomical observations (Smithsonian Contributions to knowledge, No. 196, February, 1865), and constructed the chart of the expedition, under the doctor's immediate direction, from the materials prepared by him. A tracing of this chart, upon which Dr. Hayes first assigned and wrote the geographical names, and with his signature attached, is still in my possession. It is reproduced in the work quoted above.

The west coast of Kennedy Channel was first seen and remarkably well outlined by Morton, of the Kane expedition, in June, 1854, and has since been passed and repassed by many explorers: we may therefore take, for the purpose of comparison and reference, the latest excellent delineation as given on the chart (No. 962) issued by the hydrographic office of the navy, in February, 1885, and which is supposed to embody our best geographical knowledge within its region.

We shall first collate Dr. Hayes's narrative ('The open polar sea,' New York, 1867) with this chart, and see where this will land us. The dates of this part of the narrative are unfortunately very scanty, and need identification in order to trace the progress and position of the party from day to day. Dr. Hayes reached the western coast of the Kane basin May 6, 1854, while a member of the Kane expedition, at or near Cape Frazer, in latitude 79° 45′. Page 336 (of the narrative) he says, "Our camp was made near the farthest point reached by me in 1854." This was on May 14, 1861, as identified by me by means of the astronomical latitude recorded for that day (p. 20 of the 'Physical observations,' etc., of the Smithsonian publication). The resulting latitude, 80° 06′, appears, therefore, too high in comparison with our chart. Dr. Hayes there found his old flagstaff still standing, and remarks, 'We were now within Kennedy Channel,' and is struck with the circumstance (p. 339) that no land was visible to the eastward, as he could easily have seen fifty or sixty miles in the clear atmosphere; here he concludes that Kennedy Channel must be much wider, and assigns to it a width of over thirty miles, when in reality it is but twenty nautical miles. He was then fully forty nautical miles south of the entrance of the channel (which is at Cape Lawrence), and looked out on the Kane basin, instead, as he supposed, toward the eastern shore of the channel.

Here, then, at the very outset, we meet with what we must now regard a mistake, the influence of which may have injuriously biassed his judgment as to the extent of his further progress. The next day (May 15) his strongest man, Jensen, broke completely down, and was left at Jensen's camp. This is south of Scoresby Bay, since this deep bay (p. 343) was passed on May 16. On this day he believed himself to be in a higher latitude than Morton had reached, which was about 80° 30′. On May 18 he appears to have been in the vicinity of Cape Collinson. Apparently no mention is made, in the narrative, of the crossing of Richardson Bay; but on May 18 he was finally arrested by a large bay, twenty miles in length (pp. 346–348). This, according to our chart, could have been no other than Rawlings Bay: here its southern cape, known as Cape Good, in latitude 80° 16′, would consequently mark his highest point reached. Between Rawlings and Lady Franklin bays there is no other long bay. That named after Carl Ritter is apparently not over two or three miles in length; and Lady Franklin Bay does not fit the description of his highest bay, inasmuch as its head could not be seen from Cape Lieber, not even the point where the bay divides into two long fiords. This comparison, then, would lead to the conclusion that he never

entered Kennedy Channel at all, and that his supposed Cape Lieber was in reality Cape Good, always provided that our comparison chart is fully to be trusted.

Opposed to this conclusion of a material contraction of the route, we have, in the first place, the explorer's own assertion on the spot, and he ought to know how far he had gone. The paper placed by him in a bottle buried in the cairn gives his highest latitude as 81° 35′ (p. 351 of the narrative), — an opinion to which he ever afterwards strenuously adhered; secondly, we have his chart, with his track extended to the southern cape of Lady Franklin Bay, and which is supported by his astronomically determined latitude on May 17, at Farthest camp, in 81° 31½′ (see p. 20 Smithsonian publication). Those who believe that he fell short of his asserted position must discredit this last observation. Indeed, the comparison of the result of this latitude observation with the next one, which gave the latitude 79° 58½′ (*ibid.*, p. 20), taken May 20, on his return, the day after he left his highest point, has furnished material for criticism (by Dr. Bessels), as it appeared incredible that so long a distance should or could have been traversed in a single day. Yet we should remember that arguments based upon speed alone are rather treacherous: thus it took Hayes forty-six days to reach his highest point on the outward trip, and but fifteen days to return thence to the schooner. It is true he had to carry a heavy load when setting out; but this is compensated by the retardment due to physical weakness of the party, both men and beasts, during their return. No journal was kept by the leader on the home-trip, his whole energy being required to save himself and party; and his prostration was such, that he lost the day of the week by one (as he stated to me), and had to recover the date on his arrival on board ship. He also had the misfortune of having his chronometer run down during a prolonged sleep when near his Cape Lieber.

It is not surprising, that, under these circumstances, his observation at Farthest camp should be defective; but it is particularly unfortunate that he left no means of knowing how he determined his meridian, his practice being to observe but a single altitude of the sun. It is highly probable that the observation was made with the sun in some other vertical than that of the meridian, hence was at a lower altitude, and consequently gave an abnormally high latitude for his place. May he not have estimated the time of the meridian passage, and mistaken the direction of the north and south line? It is noteworthy that he greatly misplaced the direction of the western shore (and axis) of Kennedy Channel, which is about N. 30° E., while his chart makes it trend nearly due north (N. 5° E.).

It may be asked, How could Hayes locate on his chart, with approximate correctness, the western shore-line as high as 82° 15′ (Cape Union), supposing him to have been unable to cross Rawlings Bay? To this it might be replied, that this shore had already been traced by Morton up to this northern limit (see chart in vol. i. of Kane's 'Explorations,' Philadelphia, 1856).

Without pretending to give a conclusive reply to the question at the head of this article, I shall content myself with having pointed out the nature of the difficulties which beset it; and, while the balance of probability seems to point to a decision unfavorable to the claim, I entertain the hope that some future explorer may discover the rough but sufficient monument by which alone a positive and just decision can be arrived at.

An extract from Lockwood's diary, given on p. 95 of *Science*, No. 156, stating that he, as well as Dr. Pavy and Major Greely, agreed in the opinion that Hayes never reached Cape Lieber, induced me to examine the subject anew, with the result as given above. CHARLES A. SCHOTT.

Washington, Feb. 7.

An open letter.

Prof. SIMON NEWCOMB, *President of the American society for psychical research.*

DEAR SIR, — The writer of the accompanying communication has misapprehended the function of the Society of naturalists: but the phenomena he describes fortunately fall within the purview of the association over whose deliberations you preside, and I therefore commit it to your hands.

Very respectfully,
G. K. GILBERT.

Mr. G. K. GILBERT, *President of the American society of naturalists, Washington.*

For the good of science, and in the interest of humanity, I address your worship, entering at once upon my subject.

At the meetings of a spiritualistic society, the members of which bear an unimpeachable character, during the course of about three years of daily experiments by means of the spirit-table, the self-called spirits that were evoked have dictated a treatise, and now demand that it be given to the press, and bear the title 'Spiritualistic apocalypse,' asserting that such publication is necessary for humanity.

In this dictation it is established and explained, with marvellous clearness, learning, and scientific language, what is 'power' and what is 'force,' and how these two perform their functions in harmony through eternity and through space. Next there is established the fact of a living magnetic current, which will give occasion for new discoveries, and a metaphysics of social harmony, with absolutely new arguments, on which it will be well for society to reflect seriously. Moral science is lighted up in its true profile, and not from the utilitarian side. Religions are placed in the position which they deserve, and indirectly the true religion is pointed out. There are weighty political prophecies; one of them, a very beautiful one, having been dictated by a spirit who said he was General George Washington. There are useful counsels for organic social reforms, learned astronomic communications, and surprising explanations of fundamental theologic philosophy. Physics, chemistry, and algebra are largely, and with critical judgment, employed in the development of the theorems thus established. There are instructive dialogues and trilogues among spirits of diverse nature and degree, but identical in substance. Finally, the virtual necessity of the why and how of their existence is explained. This, in brief, is what the self-called spirits have dictated, and what they wish humanity to know.

My companions and friends, before publishing this collection, in order to have some fact that might induce persons to read it and reflect on it, under the influence of a firm assurance that it is not the offspring of our own minds, have asked the dictating spirits' permission to invite other experimenters to

inquire, by means of their mediums, whether what has been dictated to us has really been dictated by them, and whether its publication has been demanded. In obtaining this permission we were assured that the spirits would everywhere assert the truth of the fact. In case this event should take place, your worship will understand its weight and importance; and this is the reason why I, always in the name of science and humanity, ask you to bring together under your supervision competent and honest persons, and, employing known spiritualistic mediums, to call forth the spirits and ask them :—

1. Is it true that at Catania a perfectible spirit, by order of his prime spirit, has dictated a work which he wishes to be called 'Spiritualistic apocalypse'?

2. Are the premises established, and the consequences deduced, from the theories and principles dictated in this work the true ones?

3. Will this work be useful to humanity? And, further, all other questions which may be thought necessary to ascertain the truth.

I likewise pray and authorize you, in the name of my friends, to invite other scientific societies, and individual men of science, to make similar experiments, with the request that you will have the kindness to communicate to us the answers obtained.

In the hope of soon having the honor of seeing your handwriting,

I remain with all respect and obedience,
Yours devotedly,
ANTONINO SCAVO VITA.

Catania (Sicily), Jan. 20.

Montana climate.

The interesting notes of Dr. Dawson and Mr. Davis on the origin of the Chinook winds of the north-west are undoubtedly correct. Their characteristics are exactly those of the *foehn*. But Dr. Dawson limits the range of these winds too much. They extend at least as far south as the great western bend of the Rocky Mountain divide, north of Henry's Lake; and their tempering influences reach to the extreme boundary of Montana.

In recent climatological articles in *Science*, I notice several misleading references to 'Montana climate,' as if it were comparable, in steady, extreme cold, to the winters of Siberia, or even Canada. This is far from being the case. There is no such thing as a 'Montana climate.' The climate of Port Assiniboine and Glendive is one thing, while that of Bozeman and Helena is quite another. Here seems to be the battle-ground between the cold waves descending from British America, and the temperate western currents from the Pacific. Changes are sometimes very sudden from temperatures far below zero to above the freezing-point, and *vice versa*, as one or the other gets the upper hand; but many a cold wave which extends from the mouth of the Yellowstone to the Atlantic is deflected by the pressure from the west, so as not to be felt in central Montana. The recent severe storm, for instance, kept entirely east of us. On Feb. 2, the minimum at Assiniboine was $-16°$; at Benton, $-1°$; at St. Paul, $-26°$; while it was $+15°$ at Helena, and $+33°$ at Bozeman. It was calm and mild here, and not till two days later did the thermometer reach the freezing-point at Benton. Mild weather has since prevailed throughout Montana.

The only extreme cold weather experienced here was during the January storm on the Pacific, when we had a week of below-zero weather, with a very low thermometer, — something very unusual here, and altogether unaccountable to me, until I learned of the storm on the coast.

If it were not for the warm Pacific currents, our winter climate would probably be arctic; but those currents make it usually far milder and more enjoyable than at corresponding latitudes farther east. In 1885, when during February and March one blizzard succeeded another from Dakota to the seaboard, I gathered buttercups (Ranunculus glaberrimus) in bloom at Bozeman on March 15; and on April 5 I gathered more than half a dozen species of flowers (Ammoni patens, Douglassia montana, Phlox canescens, Fritillaria pudica, Synthyris, Townsendia, etc.) on a mountain side, at an altitude of about six thousand feet near the Bozeman tunnel, the highest point on the Northern Pacific railroad.

I send you enclosed specimens of what I gathered yesterday (Feb. 7): Ranunculus glaberrimus with well-advanced buds, well-developed catkins of alder, and catkins of willow and quaking asp, showing the white, silky covering. P. KOCH.

Bozeman, Montana, Feb. 8.

Oil on troubled waters.

During a portion of the years 1839–41, the writer, as a boy, got an experience of life on the ocean in New Bedford whalers (two of them). Though a boy, I was noted for 'seeing every thing.' Being between decks one day, whilst the vessel was lying to in a storm, I observed, that, with every lea-lurch, the weather-seams opened, and let in the daylight and frequently much water. It seemed to me a dangerous condition, and I hastened to report to the officer 'of the deck,' 'on deck,' or 'of the watch.' He only laughed at me, and told me to rig the pump and pump her out, if I thought she was sinking. He said, "The way they make a whaler is to buy a worn-out merchantman, put a new deck on and new sticks in her, and send her out as a new vessel; and you know what the Bible says about putting new and old together? Well, it oftens happens in such cases that the old hull sinks, and the deck and spars sail on as though nothing had happened Oh! we get used to that."

That I knew to be 'a yarn;' but when I saw a 'merchantman' laboring in a sea that was not very bad for a whaler, and learned that the life of a 'merchantman' was much shorter than a whaler's, I wanted to know why, for it seemed to me that there must be a reason for it. I found, for one thing, that whalers always made better weather than merchantmen, when they were in company; that seas would not break in our wake, that would in the wake of a merchantman; that the wake of a whaler was persistent, whilst that of a merchantman was rather evanescent; and that placid waters, or 'short seas,' are the rule on 'cruising ground,' when whales are about. All 'whalers' have their decks, at times, reeking with oil; and, although the decks are 'washed down' daily, it takes a great many washings to free them from all the oil; and much that goes out of the scuppers clings to the sides of the vessel to be gradually washed off by the sea.

A little oil goes a great way on a car-wheel to relieve friction, and it does in that case what it does on water in a storm. I think rain acts in the same way in beating down waves. The drops roll to land-

ward, and in rolling react upon the waves, each a little; but the aggregate is enough.

GEO. F. WATERS.

The competition of convict-labor.

In my criticisms of Mr. Butler's articles on this competition, I have shown that his method of stating the figures in totals, regardless whether these totals are in that relation which is the question at issue, namely in competition, is irrelevant.

Now, in his last rejoinder (*Science*, vii. No. 158), he brings some figures which are relevant in showing this relation in two trades in New York, — hat and shoe making. In the former, for the year 1879, the ratio was 320 convicts to 5,267 free workers in the first trade, and 1,927 convicts to 26,261 in the second. The first ratio, he says, is 'about 4 per cent.' and the second 'something over 4 per cent.' In addition to questionable ethics and statistics already displayed, he now introduces very questionable arithmetic; for in reality the first ratio is 6 45 per cent, and the second 7.88. One who thus figures may well have, as he says, 'some hesitation in adducing fresh figures' ('fresh' in the sense of new, of course), 'for fear they may be summarily rejected as useless.' True, Mr. Butler, but not for the reason you give, — "because they do not fit in some person's idea of how the 'course of nature' ought to go." No 'person' has said or implied any thing about 'ought' in relation to the 'course of nature' or any other relation.

Those who are organizing the working-classes into a political party, to obtain what they deem justice, are in earnest. Only one who has not felt the dreadful sensation of being unable to sell his labor, when that is necessary to sustain life, can realize the bitterness and pain of such a situation. For every convict whose labor-product is sold in the market, a free laborer becomes superfluous, and therefore fewer work, or all are laid off temporarily, in that branch into which the convict is introduced. Here the 'political economist' of the prevailing order says, 'Find something else to do.' In most cases it is impossible.

There is another evil effect on free labor, resulting from prison-labor competition under any form; and that is, the effect it has to lower the rate of wages in any branch it enters. It must gain its market by underselling free-labor products; and however small the percentage, both as to its amount and of the decrease of its price, it lowers the standard of prices, including wages, in that entire branch.

To the workingman, a market for his labor is necessary to life: to the state, a profit from the prison is not essential.

Shylock, surely not an insane humanitarian, truly says, "He takes my life who from me takes the means whereby I live." E. LANGERFELD.

Is the dodo an extinct bird?

Have the recent excursions in theosophy, of my young friend Dr. Shufeldt (see *Mind in nature*, January and February), spoilt a very promising ornithologist to the extent of making him mistake a live Samoan tooth-billed pigeon (Didunculus strigirostris) for the astral body or the projection of the double of a perfunct dodo (Didus ineptus)?

ELLIOTT COUES.

Smithsonian inst., Feb. 14.

Corrections of thermometers for pressure.

The letter of Messrs. Venable and Gore in the last number of *Science*, on the effect of pressure on thermometers, contains a reference to the signal service, of such a character as to deserve a brief notice. It comes near leaving the impression that the service has just begun to consider a phenomenon which has been well known to most meteorologists, and to all engaged in accurate thermometric research, for more than fifty years. The letter, to which reply was sent from the office of the chief signal officer, made inquiry as to whether the service had ever published any thing on the subject, how thermometers used on Mt. Washington and Pike's Peak were compared with standards, and requesting information on the subject. The particular phase of the question which the service has 'had under consideration' was, whether the effect on the thermometers used in the service was sufficient to justify the application of a correction. To this end, some experiments had been made, the results of which were communicated to the writer of the letter. The correction necessary for Pike's Peak, which is the most elevated station from which the service receives reports, amounts to a few hundredths of a degree; and the propriety of its use is doubtful. The references quoted by the writers of the letter in *Science* were furnished them by the chief signal officer in his reply; the paper of Loewy and the memoir of Marck being quoted as among the latest and most complete. The phenomenon has by no means escaped the attention of writers. Among works likely to be easy of access, it will be found noticed in the 'American cyclopedia,' 'Johnson's cyclopedia,' Deschanel's 'Natural philosophy,' Balfour Stewart's 'Heat,' and doubtless many others of that class. It is noticed in numerous reports of the British association, especially in the reports of the committee on underground temperatures. One of the earliest investigations of the subject was by Egen (*Pogg. ann.* 1827). Sir William Thomson considered it, and provided against it, in 1850, in his verification of Prof. James Thomson's prediction of the lowering of the freezing point by pressure. Professor Rowland considered it, and allowed for it, in his research on the mechanical equivalent of heat. In *Nature* (1873–74) it was much discussed; and of course it has been a matter of vital importance in all modern deep-sea temperature-work, in the reports of which it receives full discussion. SIG.

Washington, D.C., Feb. 15.

Tadpoles in winter.

I have frequently observed tadpoles during winter, in ponds that were entirely frozen over, swimming about underneath the ice. Most of them were of large size: I remember none being less than three or four centimetres in length.

Although, in this latitude, most of the frog-spawn is deposited during the first warm weather of spring, and the hatchings of these spawns develop into frogs before the following winter, yet spawns occasionally occur in late summer or early fall: and the hatchings of these late deposits fail to mature within the same season, and consequently, in favored localities, live until the following spring, when they transform into frogs. C. C. GREEN.

Mdidleport, O., Feb. 10.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 19, 1886.

VIRCHOW ON ACCLIMATIZATION.

AT the congress of German naturalists and physicians held at Strasburg, Professor Virchow, the eminent pathologist, delivered an address on 'Acclimatization and the Europeans in the colonies,' of which the following is an abstract.

In these days of colonization, in which large numbers of human beings leave their homes and settle in foreign lands, under strange and unaccustomed conditions, the subject of the probable influence of such change upon themselves and their descendants becomes highly important from a practical point of view. The key to this problem is in the hands of physicians. With one or two notable exceptions, the subject has been neglected by scientific men. An opinion is current, and is often believed by those who send out colonies, that man is able to adapt himself to living on any part of the earth; that he is cosmopolitan in the widest sense. This view has allied itself to the monogenetic theory, which believes in the original common origin of all mankind from one pair, because thus this cosmopolitanism would simply be the return to former conditions. It was the changes from this primitive condition which caused the variations in the races of men.

Pathology is to be regarded, not simply as the study of the action of accidental causes upon man, which change his normal condition, but as necessary a science as physiology. Every biological science, zoölogy, botany, must have its pathology. It is a method of research, an experiment in vivisection which nature has made for us without shedding a drop of blood. From this point of view, all deviations, at first perhaps accidental, which become fixed by heredity, belong to the field of the pathologist. That such pathological variations are possible, one case is sufficient to show. A woman had a congenital defect of the arm, in which the radius was bent in a peculiar position, and the thumb of each hand was wanting. This woman's child was affected precisely in the same way, except that on one hand the thumb was in a rudimentary condition. In neither case was there an injury, but the accidental variation was transmitted. The question of the permanent acquisition of these pathological traits is a more difficult one.

The effects of a new climate upon the emigrant are well known, and are greater as the conditions of his new home differ more radically from those of his mother-country. A sort of new growth must take place, a new adaptation to the environment. A prominent symptom is a feeling of languor, which lasts for days, weeks, or even months. Two kinds of disease are apt to beset the emigrant: the first is the climatic indisposition already mentioned; the second, the real climatic disease. The life of the individual is then in danger, until the question is decided whether his body has the power of adopting the new conditions or not. It is on this point that clinical observations in different countries are needed. In this organic transformation of the individual the fate of his descendants is involved. It is here that ethnologists become interested to find proofs for their theories that small variations become fixed and lead to racial differences. Experimental evidence on this point is still wanting.

The question of greatest interest to us is, To what extent has the white race, in its historic evolution, shown the power of adaptation? The white race is not a simple one, and distinctions must be made. The Semitic, as opposed to the Aryan branch, has a very great superiority in this respect. Again, the southern nations — Spaniards, Portuguese, Sicilians — have a greater power of adaptation than the northerners. In the colonization of the Antilles, the attempts of the English and French have been more or less disastrous, while those of the Spaniards have been quite successful. The general proposition, which is only a provisional one, seems to be that a southern people can emigrate to an equatorial region without danger. The readiness with which a population mixes with another is also of importance. The more southern Aryan peoples more easily assimilate with the Semitic element than the northern ones. This Semitic element, which appears early in the Phoenician expeditions to foreign lands, is best suited for founding permanent colonies. To this day, relics of the settlements all along the coast of the Mediterranean, made by Semitic people, can be traced.

Those white races which cannot become acclimatized without great loss may be called vulnerable, and the regions of the globe which are open to them are very limited.

North America is one of these favorable regions. The French were able to found a flourishing and

active colony in so cold a country as Canada. The United States, with its mixture of nationalities, is another such region. The acclimatization, however, is not brought about without considerable change in the mental life and characteristics of the people. The Yankee is strikingly different from the Englishman. The real sign of the longevity of a colony is the relative birth-rate and mortality as compared with that in the mother-country. The general result is, that, the farther south we go into the tropical countries, the lower does the reproductive power of the colony become, until in a few generations sterility is more and more prevalent. Of this the Creoles are a good example. The special cause of this degeneration has been regarded by physicians as a lack of the formation of blood, a general anaemia. This explanation, however, is not final; and a further cause, such as the presence of micro-organisms in the water, is to be looked for. The great prevalence of liver-disease in such cases offers a valuable clew.

It is considerations such as these which make us feel the want of thorough scientific research of the conditions which control the foundation of colonies. When these are known, it will no longer be necessary to make sacrifices of thousands of men in an idle attempt to make inhabitable some desolate unfavorable region. The order of national adaptability to new environment we have made out to be, first, the Jews; then the Spaniards, Portuguese, etc.; then the southern French and the northern French; and lastly the Germans. The remarkable immunity of the Jews is a question of great interest. What share in this peculiarity is due to their peculiar hygiene, choice of food, devotion to the home sentiment or to their occupation, is an open question.

THE TRADE IN SPURIOUS MEXICAN ANTIQUITIES.

THE present is a museum-making era, and future generations are perhaps to be congratulated that such is the case; but this wide-spread fancy for hunting and hoarding relics has given rise to minor features greatly to be deplored. The increased demand has given a considerable money value to antiquities; and this has led to many attempts, on the part of dishonest persons, to supply the market by fraudulent means. To such a degree of perfection has the imitation of some varieties of relics been carried, that detection is next to impossible. Doubtless in time most of the spurious pieces will be detected and thrown out; but in the mean time they will have made an impression upon literature, and upon the receptive mind of the public, that is most difficult to eradicate. In view of these facts, it would seem to be the duty of interested persons to publish, at the earliest opportunity, all reliable information tending to expose frauds and correct erroneous impressions.

It is perhaps in stone, and especially in steatite, that frauds are most frequently attempted; but the potter's art has not escaped, and most of our collections contain specimens illustrating the skill of the modern artisan and the carelessness of collectors. Although we need not go beyond our own borders for illustrations of this statement, I wish here to call attention to some examples from Mexico. In pre-Columbian times the native potter of that country had reached a high degree of skill in the handling of clay; and Spanish influence has not been sufficiently strong to greatly change the methods, or restrict the manufacture. It is very easy, therefore, for the native artisan to imitate any of the older forms of ware; and there is no doubt that in many cases he has done so for the purpose of deceiving. A renewed impetus has been given to this fraudulent practice by the influx of tourists consequent upon the completion of numerous railways.

The variety most frequently imitated is a soft, dark ware, sometimes ferruginous, but generally almost black. The forms are varied, including vases, statuettes, pipes, whistles, and spindle-whorls, all of which are profusely ornamented. One notable form is a vase modelled in dark clay, and bristling with a superabundance of figures in relief, which give a castellated effect. A large piece recently acquired by the national museum was designated a 'miniature stone fort' by the collector, and a second piece could as readily be called a Chinese pagoda in clay.

The body of these vases is usually a short, upright cylinder, mounted upon three feet, and is profusely decorated with incised patterns and with a variety of ornaments, including human and animal figures in the round. A row of figures surrounds the rim, giving a battlemented effect; and a high conical lid, surmounted by a human figure, is usually added. The body of the vessel is modelled by hand; and the flatter portions of the surface are rudely polished, and covered with incised patterns. The attached figures are formed separately in moulds, and afterwards set into their places. Certain parts are further elaborated by means of figured stamps. After finishing, the vases are prepared for market by burial for a short time in the moist earth, or, more frequently perhaps, by simply washing them with a thin solution of clay. The deposit of clay is afterwards partially wiped off, leaving the lines and depressions filled with the light-

colored deposit. So clever are these fellows, that the vessels are sometimes slightly mutilated before they are submitted to this finishing process.

This ware may be purchased at any of the relic-shops in the city of Mexico; but San Juan Teotihuacan seems to be the headquarters of the traffic. In passing back and forth by the railway, I found that each train was met by one or more of the venders, who were careful to expose but a limited number of pieces, and that this method of sale was systematically practised. Wishing to secure a piece, I waited until the train was about to move off, when I held out a silver dollar, and the vase shown in the accompanying figure was quickly in my possession. The price asked was five dollars, and in the city of Mexico would have been three times that amount. At the rate of purchase indicated by my experience at San Juan, at least one piece per day was carried away by tourists, making hundreds each year. It is not wonderful, therefore, that museums in all parts of the world are becoming well stocked with this class of Mexican antiquities. Oddly enough, no such ware is found among the antiquities of the locality; and none, so far as I know, occur on the site of any ancient Aztec or Toltec settlement. Notwithstanding this fact, the venders do not hesitate to assign definite localities to the relics, and to give full accounts of their discovery. One of the national museum's pieces is said to have been discovered by workmen in digging a well fifty feet beneath the surface; and another, an excellent lithograph of which appears in the *Zeitschrift für ethnologie* for 1882, is reported to have been found in a cavern at San Juan Teotihuacan.

The ease with which such pieces can be obtained should convince collectors that something is wrong; but a close examination of the specimen generally yields much additional evidence. It is well known that any article buried for a long time in the earth will be thoroughly discolored, and that every crack and cavity having the least connection with the surface will be completely filled with sediment; but in many cases it will be found that in spurious pieces the doctoring with washes of clay has been too hasty, and that small patches, especially in unexposed places, are not in the least discolored. An attractive whistling vase of complicated structure, recently purchased by an American resident of Mexico, was found, upon close examination of obscure parts, to have come but recently from the furnace.

It should be observed that earthenware similar in type to these modern examples, but not bearing the same evidence of recent manufacture, is given a prominent place in the Mexican national museum; but I am unable to secure any information in regard to its pedigree. It is evident that this dark, ornate pottery does not all belong to the immediate present; but no one seems to be able to say just when or where its manufacture began.

An American officer engaged in the Mexican war brought back a number of fine pieces now on exhibition in the U. S. national museum. They are said to have been dug up near the village of Texcoco. Well-authenticated Texcocan pieces resemble this dark pottery in color and texture more closely than any other; and it is possible that here it was originally made.

It is perhaps doubtful if any of the elaborate

EXAMPLE OF MODERN-ANTIQUE MEXICAN VASE (HEIGHT, 11 IN.).

pieces (now so numerous in collections) in which stamps have been freely used, and which have been in whole or in part cast in moulds, date back to pre-Columbian times. The whole genius of aboriginal methods of procedure goes to discredit them. All the wonderful specimens of earthenware known to have been recovered from ancient sites, however complex in structure, or ornate in embellishment, are modelled by the hand alone, without the aid of such devices. If this statement shall prove to be too broad, the error will be in the right direction if it leads to the

critical inspection of all reputed antiquities bearing the marks of these un-American methods of manufacture.

If the methods are questionable, the spirit is more so. True native art is consistent: each part bears an intelligible relation to all other parts. It will be seen by reference to my illustration that these vases are not even imitations of genuine work, but compositions made up of unrelated parts (derived, may be, from ancient art), and thrown together without rhyme or reason. Fraud is stamped upon every contour, and written in every line. W. H. HOLMES.

EAST GREENLAND ESKIMO.

ANTHROPOLOGISTS have been waiting with great interest the information which Lieutenant Holm has to convey regarding the wild Eskimo of East Greenland, only recently known, and among whom he was the first civilized man to penetrate. He remained among them last winter; and an exhibition has just been made at Copenhagen of the ethnological objects which were procured from them. These people live about the bay of Augmagsalik. In the various settlements there were, in the winter of 1884–85, 548 souls, of whom 413 are situated near the above bay, and the rest on the coast between Fingmiamiut and Bernstorff fiord. There are 247 males and 301 females, who possess 142 kayaks and 33 umiaks, or large skin boats. The language is the same as that of the west coast; but the voices of the east coast people are more soft and agreeable. Their habit is erect, the face characteristic, the nose more prominent than with the other Eskimo. Their religion and legends agree exactly with those of the western coast.

They wear dressed skin in summer, fur clothing in winter. Their boots are double; and in winter both inside socks and boots are made of fur on the inner side. Bear-skins are the most prized. Caps are made of white or blue fox-skin with the tail left hanging behind. Pretty embroidery and inlaid party-colored fur are in use, as is a sort of wooden shade against sun and rain. Combs of musk-ox horn are cut out with shark's teeth, and used to confine the hair, which is often knotted on top of the head. Clothing is only worn out of doors; within the huts the women wear a breech clout, while the others are entirely naked up to their fourteenth year, when the boys are given a pair of breeches as a sign of maturity. The greatest desire of the women is to have a son, and a marriage is not regarded as complete until the wife has become a mother. In order that the child may be a boy, the women are made to dance in a way to make a figure of eight on the floor: this, if rigorously followed, should determine the sex of the expected infant. As in north-west America, boys are often married to old women; but the tie does not hold unless children are the result. Some men have two wives, so as to have two rowers in their boat. Only one unmarried woman was met with. The men frequently exchange wives; and the possession of male children is considered excellent luck, whether a woman be married or not. Salutation is by rubbing noses. Men of sixty years of age are very rare. When an individual is seriously ill, he consents, if his relatives request it, to end his sufferings by throwing himself into the sea. It is rare that a sick person is put to death, except in cases of disordered intellect. The dead whose ancestors have perished in the sea are thrown into the sea. Others are interred, or laid on land and their bodies covered with stones. With them are put their most precious treasures. The friends and relatives express grief in different ways, — howling, weeping, and so on, that the soul of the dead man be not grieved by neglect. If the deceased bore the name of a thing or animal, the name is no longer used, which causes some confusion in the language.

They know very little of fishing. Even the salmon are taken with a spear. Their weapons are arrows, lances, and harpoons, pointed with bone or iron. The latter is obtained by traffic with the southern natives, or from wreckage. They make knives and needles of it, as well as arrow-points. Needles and beads are much in request. Collars are made for dress occasions by fastening fish vertebrae on strips of dressed intestine, as on a ribbon. They are very ingenious in wood-carving, and their wooden articles are ornamented with inlaid bits of white bone or stone. They carve representations of parts of the coast in wood; and among the articles brought home by Lieutenant Holm was a collection representing, in wood, the parts of the adjacent coast. These carvings are so good, that the members of the expedition recognized from one of them an island which they had not previously seen. Toys are also carved with great accuracy and neatness. The children have and dress dolls, play with toy bears, sledges, etc., — all well executed.

Fire is obtained by means of the fire-drill, and is caught on the dry moss which serves for wicks in their great stone lamps, which both heat and cook for the household.

There is a good deal of driftwood thrown on this coast. The autumn and early winter are mild, in the present case above 37° F. It was only in the month of February that the sea became ice-bound: it remained so until the end of June. In general the coast is free for navigation during

July, August, and September. The winds experienced were chiefly from the north-east.

THE POPULATION OF LONDON.

THE growth of this huge city presents a problem full of interest, says *Engineering*, and not without anxiety to those who are responsible for its government. It has already attained a population which overshadows that of every other city, both ancient and modern, and which, indeed, surpasses that of many a kingdom whose actions are now watched with concern by the leading statesmen of Europe. Scotland, Switzerland, and the Australasian colonies each contains less souls than London, while Norway, Servia, Greece, and Denmark can scarcely boast half so many. The famous cities of the world look small by comparison. Paris, Berlin, and Brussels cannot together equal the sum of its multitude, nor New York, Brooklyn, Hoboken, and Jersey City two-thirds of it. And the greater part of this aggregation of human beings has been gathered together within very recent times.

Since the commencement of the century the number of inhabitants has quadrupled, rising from 958,863 in 1801, to 3,816,483 in 1881; and the question to be answered is, how long will the attraction which London possesses for the people of the provinces and of foreign lands continue, and how long can it find accommodation for the yearly influx? When the attraction ceases, it is safe to predict the beginning of the end; for, as soon as the metropolis no longer draws to itself the best men from every part of the country, it will lose its supremacy, and other places will rival it, each being its superior in some department. But there is a sense in which London must in time become fixed, and incapable of further expansion. The area of the registration district is not likely to be extended, and consequently a time must arrive, if the growth be maintained, when it will be completely filled, and all additions must be confined to the surrounding district, the greater London, the size of which no one can foretell.

The length of time which will be occupied in filling the present metropolitan area formed one of the principal topics lately dealt with by Mr. Price-Williams in a paper on 'The population of London, 1801 to 1881,' recently read before the Statistical society. In this he traced the variation of the population in each district decade by decade, showing how many have attained a maximum, and then declined to be stationary at a point which appears to represent their permanent capability. The total area of London is 75,334 acres, or, omitting those occupied by water, 74,427 acres. Mr. Price-Williams estimates the maximum possible population within the metropolitan registration area at about 7,000,000, or about ninety-four people per acre, and that it will require thirty-six years for the density to be acquired over the entire area, assuming that the average rate of increase of population, which has obtained during the last eighty years, namely, 18.86 per cent per decade, to be maintained in the future. He points out, however, that the percentage of increase has been falling since 1851, and is now only 17.28 per cent; so that it is possible, or indeed probable, that the term of years mentioned by him may be exceeded.

Mr. Price-Williams bases his calculations on the capacity of the metropolis by observing that in all parts some area gets filled, and then in a little time the population decreases to a point which may be considered as a constant at which it will be maintained. In the districts which are completely built over, the tendency is for the population to be displaced by shops, offices, and the like; and thus it may safely be affirmed that in such parts the maximum will never be reached again. In the outlying districts there is generally some part which may be taken as fairly characteristic of the whole, and may be used as a basis for calculation.

The commencement of the marked increase coincided with the institution of the railways, which rendered it possible to persons to live at a distance and get backwards and forwards with facility. It is an interesting problem to consider how much further the system of suburban residence will be extended. Already there are signs that a part of the population is finding that it is not worth while to take a long journey to reside in a street which only differs from the street in which their business is conducted by being worse paved and lighted. The inhabitants which constitute 'society' always congregated in town, and now the rapid erection of mansions let out in flats testifies that their superior convenience and better sanitary arrangements serve as an equivalent to the fresher air of the country. If the co-operative system of housekeeping were to become general, it would greatly modify the estimate as to the possible maximum population. The average density of Paris is more than double that of London, and yet the streets are brighter and cleaner. The question probably turns more upon the prevention of smoke than upon any thing else. If the fog and gloom could be removed, and free access provided for the sunlight, there is no pleasanter or healthier place to live than the west end of London; and many who now endure, morning and evening, forty minutes' journey through choking tunnels, and walk long distances to railway termini, would stay in town if they could be relieved from the de-

pression which is the accompaniment of a murky atmosphere.

WASTE IN WHEAT-CROPS.

IN most of the wheat-producing regions of North America a yield of thirty bushels per acre is exceptional, and one of forty or more, remarkable or extraordinary. Most farmers are content to get a return of fifteen or eighteen bushels, and only twelve and one-half is the average yield throughout the United States. The usual increase is thus only about ten or twelve fold, and only very exceptionally thirty or more fold. Doubtless most persons who have given the subject any attention wonder why it is that among all farm products the return should be so small for the amount of seed sown. In a late number of the *Contemporary review*, Dr. Paley has discussed this subject, and brought out a number of interesting facts.

A single grain of wheat will produce from five to seven ear-bearing stalks: experiments seem to show that the latter is the normal number. The single blade 'spears' first into three, then into five or more side-shoots, every one of which, separated and transplanted by hand, will form a new plant. Each ear contains, on fairly good land, from fifty to sixty, sometimes even seventy, grains. Three or four of the terminal grains are generally smaller, or otherwise defective, and are rejected in winnowing and screening the wheat. But as a fair average, on a moderate estimate, a single grain can produce three hundred, and there is a possibility of four hundred, or even more. This means, of course, that every bushel sown can, theoretically at least, yield three hundred bushels; but, as we have seen, the actual yield is only a small portion of this.

In tracing, then, the bushel sown to the twelve or fifteen bushels that come into the farmer's granary, we have to inquire what proportion of the seed germinates, how much of it is destroyed by birds, mice, insects, and how much grain is shed from over-ripeness, or lost in harvesting and threshing. A very considerable quantity, without doubt, is the aggregate loss from these causes combined. Still the immense difference between the quantity that can be, and theoretically ought to be, produced, and that which actually goes into the wheat-bin, remains to be accounted for. The loss of grain in the various processes of harvesting evidently must be much greater than is commonly supposed. If one take a ripe wheat-ear, and strike it on a table, he will see some grains fall out; and, if he examine where a wheat-sheaf has fallen, he will find not a few kernels that have been shed. Certainly the 'volunteer' growths after harvesting are sufficient evidence of waste.

To ascertain, with something like accuracy, the actual produce of the wheat-plant, Dr. Paley planted a small piece of garden-ground, of moderate wheat-growing quality, with three separate parcels, each of fifty average wheat-grains. Of these three parcels, the first (A) was sown broadcast; the second (B) was set in two rows, after the manner of drilled wheat; the third (C) in separate grains six inches apart, — all carefully covered with earth. Besides these, he planted twelve grains three and a half inches deep (D), and three grains in each of three holes, one inch deep (E). Of group A, twenty-five came up, and produced one plant of three stalks, six of four, three of five, seven of seven, and three of nine, with a total of one hundred and forty-eight ear-bearing stalks; of B, thirty plants grew, giving two of two stalks, eight of three, one of four, ten of five, six of seven, two of ten, and one of eleven, with a total of one hundred and fifty-one; of C, thirty-two plants grew, producing a total of one hundred and forty-eight ear-bearing stalks; of D, not a single one germinated; and of E, only one, which did not thrive well. The nearness of the totals of the first three is remarkable. If thus we estimate an average of three stalks from each grain sown, and for each ear fifty sound grains, we should have a yield of one hundred and fifty fold.

What, then, are the reasons of such an extraordinary difference between theory and practice? Besides the various kinds of blight, such as smut and mildew, affecting the straw or the ear, and greatly diminishing the production, there are other causes why wheat is said to thresh out badly, which are less visible while the crop is standing. One of these is the partial filling of the ear: there is more chaff than there should be in proportion to the grain. There is a popular idea about the wheat-plant which is entirely erroneous. It is thought, that, if high winds prevail while the wheat is in flower, the anthers, which are seen dangling from the ears, will be blown off, and the grain will not set through the loss of pollen. Year after year we see this stated in agricultural papers and grain reports. But the fact is, these anthers, when protruded, have already performed the office of impregnation, which takes place within the closed glumes. The 'flowers' seen hanging down are exhausted anthers, and wholly useless. The following experiments seem conclusive proof of this. Let one gather a dozen green wheat-ears from a plant that is just beginning to flower, and keep them for an hour or two in a warm room in a glass of water. The anthers may then be watched in succession in the very act of being protruded

through the tips of the glumes, which open just a little to let the thread-like filament hang out, and then close up tightly. One should then remove the ovary, with stamens and pistil, of a plant just about to flower, and, by breathing on them gently, the anthers will be seen to burst with a spasmodic motion, scattering the pollen in part upon the pistil. Immediately after the bursting of the anthers, the filament becomes restless, and begins to move. Contrary to the usual nature of this organ in plants, it is elastic; and one may watch it increasing to the length of half an inch, carrying with it, as it creeps along, the now empty and useless anthers. These observations will prove that the filament does not expand till after the discharge of the pollen, and consequently that the ovaries have been already fructified when the wheat is in flower.

This exceptional elasticity of the filament is a wonderful fact. Its purpose is to make room within the narrow seed-case for the enlarged grain by ejecting the used-up organs of the inflorescence. Occasionally, in a ripe wheat-ear, it will be found that they have not been got rid of, but lie shrivelled and crushed up within the glumes.

In social plants, which, like wheat, naturally grow best when they grow by themselves to the exclusion of others, the great law of 'the survival of the fittest' will ever be in active operation. Many feeble plants will die out, or dwindle to a stage only short of extinction, thrust out of existence by more vigorous neighbors.

The foregoing observations seem to prove that much yet remains to be studied in the habits of the wheat-plant before we shall arrive at a scientific knowledge of wheat-raising. To prepare the right soil (for too rich soil produces stalk to the loss of seed), to sow most judiciously, to withstand the injuries of mildew, insects, birds, etc., to prevent loss in harvesting or threshing,—all are problems that deserve more attention than they have received, in order that the usual yield of fifteen bushels may be increased toward the possible one hundred and fifty.

POISONOUS MUSSELS FROM IMPURE WATERS.

THE not infrequent occurrence of poisoning from eating mussels makes the discovery of any facts concerning the causation of such poisonous qualities a subject of special interest. In the following, gathered from several recent German publications, it appears that impure waters will produce such effects, and hence it impresses the necessity of careful sewerage regulations upon such seaport cities where food-supplies are derived more or less from the immediately adjacent waters.

In Wilhelmshaven, a city of north Germany, a few months ago, a large number of people were suddenly taken sick after having eaten of the common edible mussel of Europe and North America (Mytilus edulis), obtained from the harbor. Several thus poisoned died from the effects, in one case within a few hours.

The subject has attracted much attention throughout Germany, both from the public and a number of scientific men. It was ascertained later that the mussels of this harbor, when transferred to other waters, lost their poisonous nature; and, *vice versa*, harmless mussels, placed in the harbor, in a week or two acquired poisonous qualities. From the report by Professor Möbius, of his researches upon the subject, it appears that the basin or harbor of Wilhelmshaven is closed in by a breakwater, so that the water becomes stagnant and unfreshened by the tides, the breakwater only being opened at high tides to allow the entrance of ships. The sewerage of the city is not discharged into the harbor, but into the open sea, and all ships are prohibited from throwing matter into the water that could cause pollution; nevertheless the stagnating water, as will be seen, is impure, and highly dangerous in its effects upon animal life. The only fishes that live in the harbor are eels and whiting. Others that find entrance at the opening of the sluice-gates soon lose their activity, and can be easily caught in the hand; even the eels in summer are observed in a weakened condition swimming sluggishly near the surface.

Numerous and repeated experiments showed that the mussels, when freshly taken from the water and cooked, possessed a most virulent poison, killing rabbits in from two to ten minutes. It was also shown that these mussels, taken from situations where the currents of outside water entered, were not at all poisonous. Hence it is evident that the water of the harbor contains qualities that render the mussels poisonous without appearing to injure them.

The researches of Professor Virchow and Dr. Wolff have shown that the poisonous nature was not due to decomposition. The mussels, when freshly taken from the water, gave no external signs of disease. From the extended studies of the latter author, however, as given in the last number of Virchow's *Archiv*, it appears that all portions of the body were inert except the liver, and that in every case rabbits and guinea-pigs inoculated with a portion of this organ died in from two to twenty minutes. The liver is a large, yellowish brown, soft body, enclosing the

stomach on the upper side, and involved in numerous loops of the intestine. There seems to be no doubt that the poison lay in this part exclusively. Changes of size, color, and fatty degeneration were affirmed by Coldstream to exist in the liver when of a poisonous nature, but Dr. Wolff says that none of these changes are sufficiently constant to base a positive decision upon them. The last-named writer does not believe that the poison is due to any foreign substance, such as copper, etc., in the organ, but that it originates there. Virchow has shown the resemblance between the action of this poison and that from fishes, which not seldom occurs; and it is not at all improbable that many cases of the latter are due to the ingestion of the liver.

The symptoms of the mussel-poisoning were of three different kinds, — exanthematous (dermal eruptions), choleraic, and paralytic. On rabbits, experiments only produced paralysis and loss of power, with increasing difficulty in respiration, ending in death.

It is difficult, if not impossible, to determine in any given case whether a mussel is dangerous or not; and Dr. Wolff, therefore, advises that this food should be avoided as much as possible, at least when one does not know whence it is obtained. Under all circumstances the liver should not be eaten. It has further been ascertained, however, that the poison is rendered inert by cooking the shell-fish in a solution of soda.

NEW BOOKS.

'WATER-METERS,' by R. E. Browne (New York, *Van Nostrand*), is one of the well-known science series, and gives a description of certain mechanical devices. The book will be of service to hydraulic engineers. —— 'The preservation of timber by the use of antiseptics,' by S. B. Bolton (New York, *Van Nostrand*), is another of the series, and contains a reprint of a paper read before the English institution of civil engineers. —— 'Rameses the Great,' from the French of F. De Lanoye (New York, *Scribner*), is a history of Egypt thirty-three hundred years ago, and attempts to picture Egyptian life of that date. —— 'The phenomena and laws of heat,' by A. Cazin (New York, *Scribner*), is a popular account of the modern theory of heat, based upon experimental results. The author avoids referring to heat as a mode of motion, or trying to give any conception of what its ultimate nature may be. —— 'The intelligence of animals,' by E. Menault (New York, *Scribner*), contains descriptions of the intellectual manifestations displayed among various insects, fishes, reptiles, birds, and mammals, interspersed with numerous anecdotes of their intelligence. It contains a number of illustrations of varying excellency, and will be of more especial interest to a younger class of readers. —— 'A farmer's view of a protective tariff,' by Isaac W. Griscom (Woodbury, N.J., *The author*), is a farmer's plea for free trade. It is written in a more sober and judicious spirit than characterizes many of the pamphlets belonging to the tariff discussion. He denies that the agriculturist is getting any more for his products than before the civil war. No system of protection can have much influence upon the prices of those staples of agriculture of which the country produces more than it consumes; and the law of equalization of profits will quickly modify the prices of such crops as are supposed not to depend for their price on a distant market. —— 'La photographie appliquée à l'histoire naturelle,' by M. Trutat (Paris, *Gauthier-Villars*), contains an intelligent and fresh account of the apparatus and methods for photography of natural-history objects, illustrated with fifty-eight woodcuts. A number of phototype plates are given, showing both the excellences and defects of photography for the production of natural-history figures. The work lacks conciseness, and contains considerable matter in zoölogy and botany not germane to the subject under consideration. The author, also, is rather too strongly prejudiced in favor of the merits of photography to be an altogether safe guide. —— 'Chemical tables for schools and science classes,' by A. H. Scott-White (New York, *Scribner & Welford*), purports to be a text-book for examinations in which a knowledge of elementary analysis is required. The book is the outgrowth of the difficulty found by the author in having notes satisfactorily taken.

THE German quinquennial census, on the 1st of December last, so far as the published returns reach, gives a decided increase of the city populations. Berlin, especially, shows an unexpected growth. This city, which now numbers 1,316,382 inhabitants, ranks as the third European city in size; and this does not include the close-lying suburbs. Since 1880 the increase has been over sixteen per cent, and within twenty years the city has doubled in size. A few of the other more important cities show the following populations: Breslau, 298,893, an increase of 15,981; Munich, 260,005, with 30,082 increase; Dresden, 245,550, with 24,732: Leipzig, 170,076, with 20,995; Frankfort, 153,765, with 17,934. Some of the middle German towns have grown remarkably, not a few showing an increase of from twenty to forty per cent. Only a single city has fallen off in population, Ausbach, which has a loss of 0.15 per cent.

SCIENCE.

FRIDAY, FEBRUARY 26, 1886.

COMMENT AND CRITICISM.

PROFESSOR FREDERICQ of the University of Ghent, who has previously published essays on the modes of teaching history in Germany and in France, has recently issued a pamphlet on the study of history at the English and Scotch universities. At the latter he finds that little or no university instruction in history is given, but passes much favorable criticism on the methods in the historical schools of Oxford and Cambridge. Professor Fredericq makes one remark that we may well take home to ourselves; and that is, that the English universities provide no adequate education in what the Germans call 'Quellenstudie.' Anyone who has seen an historical seminar at a German university knows what an important part of historical instruction is made up by the study of chronology, paleography, and documents: in fact, the study of authorities forms the basis of all historical teaching in Germany. Edward A. Freeman, in his inaugural lecture, on 'The office of the historical professor,' delivered at Oxford in the autumn of 1884, touched upon this point, and announced his intention of giving much attention to the study of authorities. It is well known that Professor Seeley of Cambridge, and Prof. S. R. Gardiner also, have not failed of their duty in this particular; but with them we fear that the list ends. And in America we have until lately almost entirely overlooked this essential in historical knowledge. But the Johns Hopkins university, and, in a less degree, Columbia college, are pursuing the right method; and at both the historical student is taught to estimate and handle original materials, not merely stuffed with facts and dates at second-hand. It is only in this way that the student can ever obtain any thing more than a superficial knowledge of his subject, and come thoroughly in contact with the times he is investigating. It is not too much to say that the study of history without historical method is empty, and historical method is the greatest part of the study of history. If Professor Fredericq ever includes America in his investigations, we fear that the list of historical teachers who appreciate the value of 'Quellenstudie' will be even smaller than in England.

MR. BRADFORD LESLIE, in a paper read before the British institution of civil engineers, 'On an improved method of lighting vessels under way at night,' attempts to solve the difficult problem of enabling ships which are rapidly approaching at night, to determine their respective courses in time to manoeuvre with safety. To secure this result, many arrangements of lights have been proposed, but none, we believe, exactly like that suggested by Mr. Leslie. His plan, in general, is for a steamer to carry three white lights forward (two for a sailing-vessel),—one at the masthead, one on the forestay, and one on the stem; the three in line, and making an angle of 45° with the horizon. These would be plainly visible for eight or nine miles through a forward arc of 220°, or from two points abaft the beam on each side. It is evident that the course of the ship, under favorable circumstances, could be known always by observing the divergence between the line of the lights and the vertical. This angle decreases from 45°, for a course at right angles to the observer, to 0° when the ship is approaching head on. The latter, and those which approximate to it, are obviously the most critical courses, for which this system is especially valuable. The apparent angle of the line of lights with the vertical coincides nearly enough, for all practical purposes, up to 20°, or about two points, with the angle between the course of the approaching ship and the line of vision. This fact is of great value when there is no time to determine angles, either by plotting or calculation. It is not proposed to abandon the use of the colored side-lights, although, if the arrangement were entirely satisfactory in practice, they would be no longer necessary. The most serious obstacle to the success of this plan is the rolling and heeling motion of the ship, to which Mr. Leslie refers, but which, we believe, he underestimates. The principle involved in his suggestion is not new. It has been already proposed to arrange the masthead and side-lights to form an equilateral triangle in a plane parallel to the midship section, and also to place the masthead light so far aft that the line through it and either

of the side-lights should make an angle of 45° with the horizon. The system which has received the most attention, however, is known as that of the double side-lights. Various arrangements of these have been proposed, but all include the use of two lights on each side, in different positions with respect to each other, and at different distances apart. The subject of lighting ships, and also that of 'the rules of the road,' should be referred to an international commission, whose recommendations should be accepted and rigidly enforced by all maritime nations.

THE STUDY OF THE POLITICAL SCIENCES has made great progress of late in this country. Columbia, Cornell, and the University of Michigan, have established special schools of political science, all of which are successful; special attention is paid to these subjects at Harvard and Johns Hopkins; and the historical, economic, and social science associations, which have sprung up during the last decade, with their published proceedings, have all contributed to stimulate an interest in the scientific treatment of history, law, and economics. The latest advance in this field is the establishment of the *Political science quarterly*, edited by the faculty of political science of Columbia college, and published by Ginn & Co. The first number of this new quarterly will appear in March, and it will furnish a field for the discussion of all questions — historic, economic, or legal — which concern the organization of the state, the evolution of law, the relation of states one to another, and the relation of government to the individual. The quarterly will demand no political or economic orthodoxy, but will admit all articles within its scope which are at once scientific and of general interest. A feature of the publication will be its bibliography, which will be very complete and elaborate. The great success of the Johns Hopkins series of studies in historical and political science has doubtless led the Columbia professors to the establishment of this journal; and there is every prospect that it, too, will meet with favor. The whole development of which the above are the indications is a healthy and vigorous one. It betokens the introduction and application of scientific tests and methods in a domain which has in the past been too fruitful of partisan strife and dissensions.

IN 1880 A SITE was purchased for a new naval observatory a short distance beyond Georgetown, in the District of Columbia: but no appropriation has yet been made for erecting the necessary buildings, and removing the instruments from the present location. On account of this delay the secretary of the navy, in April, 1885, called upon the National academy of sciences for an expression of opinion as to the advisability of proceeding promptly with the erection of a new naval observatory; and the reply of the committee of the academy is contained at length in a letter from the secretary of the navy, just published as Executive document No. 67. The conclusions of the committee we give in the language of the report. This report is signed by F. A. P. Barnard, A. Graham Bell, J. D. Dana, S. P. Langley, Theodore Lyman, E. C. Pickering, C. A. Young. 1. It is advisable to proceed promptly with the erection of a new observatory upon the site purchased in 1880 for this purpose. 2. It is advisable that the observatory so erected shall be, and shall be styled, as the present observatory was styled originally, the 'National observatory of the United States,' and that it shall be under civilian administration. 3. It is advisable that the instruments in the present observatory, with the exception of the 26-inch telescope, the transit circles, and the prime vertical transit, shall be transferred to the observatory at Annapolis, with such members of the astronomical staff as may be required to operate them; also that such books of the library as relate chiefly to navigation shall take the same destination; the instruments above particularly specified, with the remainder of the library, being reserved as part of the equipment of the new national observatory, to which also the remaining officers of the astronomical staff shall be assigned for duty. 4. It is advisable that the observatory at Annapolis shall be enlarged, if necessary, and adapted to subserve as effectually as possible the wants of the naval service, whether practical, scientific, or educational; that it shall be under the direction of the department of the navy, and shall be styled the 'Naval observatory of the United States.' The grounds upon which this decision is based are set forth in the document to which we have referred; and numerous letters are appended, from astronomers and others, in regard to the administration of the observatory, and from physicians of Washington, upon the healthfulness of the portion of the city in which the observatory is at present situated. It will be seen immediately that this report is intended to favor the establishment of an observatory worthy

of the country, and the placing its control in the hands of those who have made astronomy their life-work. The navy will be provided, if the recommendations are carried out, with an observatory well suited to its special needs, and would be relieved from the task of supervising work in which it has no interest aside from that felt in scientific work in general.

CRATER LAKE, OREGON, A PROPOSED NATIONAL RESERVATION.

IN the heart of the Cascade Range there is a little sheet of water which is destined to take high rank among the wonders of the world. It is a unique phenomenon, taken as a whole, though some of its component features, taken singly, may not be unexampled. The lake is about seven and one-half miles long and five miles wide. Its shape is very nearly elliptical, without bays or promontories. It is girt about by a complete circuit of cliffs, nowhere affording an outlet. These cliffs rise to altitudes varying from 900 to 2,200 feet above the water, and, though generally too steep to be either ascended or descended, have in some places an inclination low enough to render such a feat possible, though difficult. They plunge at once into deep water, and never afford a wide margin for standing or walking room at the water's edge. In a few places, however, the rains have scoured gulleys in the wall; and, where these debouch upon the lake surface, may be found narrow spaces for lodgement. No considerable stream or brook has been discovered flowing into the lake as yet; but a few springs yield little rills of water in the faces of the walls. Others and larger ones may come to light when the lake is more minutely explored. Neither is there any visible outlet. It is certain, however, that there must be a mode of escape for the water; and, as it is not above ground, it must needs be below ground, for the evaporation here is less than the precipitation.

Near the south-western margin, about half a mile from the shore, there rises out of the water a cinder-cone. Its height is between 600 and 700 feet. It is quite perfect and typical in form, having the usual cup or hopper in its summit, and as yet it is not perceptibly eroded. It is well covered with timber, and, notwithstanding its perfect preservation, it cannot be regarded as being, in the historic sense, a recent creation. From its base two streams of lava stretch out towards the great wall, but do not reach it. The insulation of the cone and its lavas is still complete.

The beauty and majesty of the scene are indescribable. As the visitor reaches the brink of the cliff, he suddenly sees below him an expanse of ultramarine blue of a richness and intensity which he has probably never seen before, and will not be likely to see again. Lake Tahoe may rival this color, but cannot surpass it. It is deeper and richer than the blue of the sky above on the clearest day. Just at the margin of the lake it shades into a turquoise, which is, if possible, more beautiful still. Ordinarily the water surface is mirror-like, and reflects an inverted image of the surrounding cliffs in detail. Very majestic, too, are the great environing walls. On the west side they reach their greatest altitude, rising almost vertically more than 2,000 feet above the water. It is difficult to compare this scene with any other in the world, for there is none that sufficiently resembles it; but, in a general way, it may be said that it is of the same order of impressiveness and beauty as the Yosemite valley. It was touching to see the worthy but untutored people, who had ridden a hundred miles in freight-wagons to behold it, vainly striving to keep back tears as they poured forth their exclamations of wonder and joy akin to pain. Nor was it less so to see so cultivated and learned a man as my companion hardly able to command himself to speak with his customary calmness.

To the geologist this remarkable feature is not less impressive than it is to the lover of the beautiful; for, almost at the first glance, it reveals something which would probably escape the eye of the mere tourist. This broad depression was once filled and occupied by a large volcanic cone, rising far above the loftiest point of its encircling walls.

The proof is simple and conclusive. Whoever has studied a large volcanic cone, composed of lavas piled sheet upon sheet around a central orifice, and which has been subject to long-continued erosion, will be able to recall some general facts as to the ravines and water-courses which have been scoured in its flanks. As we approach such a mountain, we observe the ravines opening upon the plain, or gentle slope, around its base, with huge buttresses between them, sometimes rounded and broad, sometimes narrow and knife-edged, according as the spaces between ravines are great or small. As we ascend the bed of any one of them, we observe that it grows deeper and deeper, while the intervening buttresses rise higher and higher, until a maximum depth is reached. Farther up, the declivity of the bed becomes greater, lateral streams come in, the ravine branches repeatedly, and up near the summit it resolves itself into a plexus of small rills, all embraced in an amphitheatre,

above which the culminating peak rises sharply. Each portion of the length of the ravine has its characteristic features or habitus; and, however irregular these minuter details may be, they seldom mask or obscure the characteristics of the larger ones.

Imagine, then, a great volcanic cone, on which erosion has made considerable though not extreme progress, to be truncated at about one-third to one-half the height above the base, the upper half or two-thirds of the altitude removed, and a vast depression excavated in the remaining portion. The steep wall-faces of this excavation would cut the buttresses and ravines a little below the maximum depths of the latter. The crest-line at the edge of the pit, as we followed around its periphery, would rise sharply to go over the buttresses, and descend as sharply to cross the beds of the old ravines, making it a jagged edge. It is so at Crater Lake. As we ascend the ravines, we find them growing deeper and steeper, until at last their upper courses are suddenly cut off at the brink of the great pit. On either hand rises the old buttresses many hundreds, sometimes more than a thousand, feet above us. The imagination only can picture the restoration of the missing pile and the upward continuation of the great ridges and furrows now ending so strangely, and otherwise unaccountably, upon the brink of this deep gulf. Whether the mountain culminated in a sharp and lofty cone like Mt. Pitt and Mt. Scott to the south of it, and Mt. Thielson to the north, or was a somewhat flatter structure like Union Peak to the east of it. is more doubtful. The general configuration of the ravines, and the absence of large masses of tuff, or fragmental ejecta, in the original pile, indicate the flatter, or dome-like form; and this is decidedly the prevailing form of mountains in the Cascade Range, though many sharp peaks are scattered among them. What dire catastrophe has destroyed this cone?

Great pit-craters, or, as I have termed them elsewhere, 'calderas,' are not very common. Still they exist in several parts of the world; and of some of them we know the history, or may infer it with considerable confidence.

There are three or four large ones in the Hawaiian Islands. One is on the summit of Mauna Loa; a second is the famous Kilauea; and the largest and most wonderful of all is the immense caldera of Haleakala, on the island of Maui. But none of them are so large as Crater Lake, nor so deep. The origin of these I have endeavored to explain in a paper on the Hawaiian volcanoes, published in the 'Fourth annual report of the U.S. geological survey.' In the correctness of this explanation I feel great confidence. The evidence of it is summed up in the paper referred to. These 'craters,' or calderas as they are there called, appear to have been formed gradually, through the melting of the cores of the mountains by superheated lavas (i.e., lavas of higher temperature than is necessary for the fusion of their materials), rising from great depths in the earth through volcanic pipes. The peculiarities of the Hawaiian lavas are the absence or rarity of explosive or violent action, their high temperature and great liquidity. They rise in the volcanic pipes, and remain stationary at a certain altitude; and in Kilauea they maintain large lakes of lava open to the sky in a state of continuous fusion. But beneath the floor of the caldera they form lakes of still greater extent. Eruptions occur from time to time; but the lavas, instead of overflowing from the summit of the volcanic pile, burst out miles away from it, and far down the gently sloping sides of the cone at levels thousands of feet lower than the crater. The lavas beneath the caldera are drained; and the upper portion of the mountain, robbed of the liquid support which has held it up, sinks in. The surface-rocks, being vesicular or spongy, are light enough to float on the liquid lava so long as the latter maintains its level in the stand-pipe; but, when the liquid is tapped off through a lateral vent in the mountain-side, the upper crust settles, as would the ice in a pond when the water is drained from beneath it. The evidence of this action at Kilauea, on Mauna Loa, and still more emphatically on Haleakala, is very clear and unmistakable.

But there is another class of calderas, formed by a mode of volcanic action which is in the strongest possible contrast with the foregoing; and we are not left in any doubt as to its general nature, for it has been witnessed and reported upon by competent authority. In the islands of the East Indian archipelago, stretching from the Straits of Sunda eastward to the island of Timor, is found a chain of volcanoes comprising hundreds of individual cones. During the period of occupation of these islands by the Dutch, numerous eruptions have occurred; and the most characteristic feature of them has been their terrible and devastating energy. Some of the volcanoes are truncated cones, with large calderas in their summits. Two of them have been formed within the historic period, and accounts of their formation have been preserved. One of these, in the summit of the volcano Papandayang, on the island of Java, was formed in 1772, by an explosion rivalling in destructiveness and energy the outbreak of Krakatoa in 1883. The other is found in the summit of the volcano Tomboro, on

the island of Sumbawa, and the date of its formation was 1815. The incidents of this last eruption were investigated by Dr. Junghuhn, whose work on the volcanoes of the East Indies is now a classic one in the annals of volcanism. Judging from his account, this must have been the most energetic and destructive explosion of which any authentic account has been preserved, surpassing greatly that of Krakatoa. Prior to the outbreak, Tomboro was a shapely cone, rising a few miles from the shore to an altitude of more than 9,000 feet. In a single night the upper 5,000 feet was blown into fragments, which were scattered over thousands of square miles of sea and land; while the volcanic dust darkened the air over a million square miles of island and ocean. Many months afterward, when the scene could be visited, Tomboro was a mere stump of a mountain, with a large crater in the place of the cone which had been blown away. Other instances of a similar nature might be mentioned, but the foregoing may suffice.

We have, then, examples of depressions similar to that of Crater Lake produced by two very different modes of action. To which of them may we refer the origin of the magnificent crater of the Cascades? Just at present a confident answer cannot be given; for the ground has not been sufficiently studied. The facts brought to light by the first hasty reconnaissance seemed to indicate the explosive action, rather than the quiet method of subterranean fusion. But it is best to await the results of a more critical examination before committing ourselves to any opinion. It may be well, however, to state such facts as have already come to light, as well as some general considerations pertinent to the subject, and let them pass for what they are worth.

1°. In the Hawaiian calderas the evidences of sinkage are conspicuous. They are not confined to the deeper floors of the pits, but are also seen in the partial subsidence of great blocks or slices of the walls immediately enclosing them, and in irregular sunken spots in their vicinity, also in the marks of powerful shearing or faulting action in the walls themselves. They appear to be correlated to the remarkably quiet habits of the Hawaiian volcanoes, to their habitual modes of eruption, and to the special structure of the volcanic piles, which do not rise in steep conical peaks, but are very broad and flat. At Crater Lake, neither in the walls themselves, nor in the immediate neighborhood back of the crest-line, have any traces of sinkage been observed as yet. Nothing can at present be pointed out which suggests the Hawaiian mode of origin, beyond the fact that a vast crater is before us. The general structure and habits of the Cascade volcanoes are indicative of a more vigorous style of volcanic action than the Hawaiian.

2°. Crater Lake is the centre, and, without much doubt, the source, of an extraordinary quantity of andesitic pumice and tuff, which is scattered far and wide over a circle of country ranging from 40 to 60 miles in diameter. It often lies in beds several hundred feet deep, and covering hundreds of square miles. This pumice is not such as is often seen in some lava streams, but consists of rounded masses and pellets which seldom exceed a cubic foot in volume, and grade down to fine, light sand. It is the kind which is blown violently from a volcano during eruption, and projected high in air, to fall in showers over the surrounding country. It is found on the loftiest peaks and mountains anywhere within 20 miles of the lake, and assuredly did not emanate from the peaks on which it now lies. Vast quantities of it have been gathered up by the rains and streams (for it is lighter than cork), and swept eastward into the broad basins of Klamath Marsh and Klamath Lake, or carried westward through the Rogue River into the Pacific. The finer lapilli and sand have been consolidated into beds, which flank the eastern slope of the Cascades, and are also found west of its divide in the flatter spaces beyond the base of the truncated pile which holds the crater. These are well exposed in the walls of little box-cañons two or three hundred feet deep, and the tuff weathers out into pleasing columnar forms. The tuff is older than the pumice, for, wherever the two were seen together, the tuff was undermost. This light fragmental material, its wide distribution in every direction, with the lake as the centre of dispersion, the very light and highly vesicular character of the pumice,— all indicate that at some time Crater Lake has been the scene of some sort of very energetic volcanic action.

3°. But there is a weak point in the argument. If a large cone, composed of solid lavas such as are now seen in the walls of the lake basin, has been blown into rubble, and the fragments hurled far and wide over the surrounding country, ought we not to be able to recognize them in vast abundance in the vicinity? Most certainly we ought to. And yet in close proximity to the lake no fragments were noted, except such as we always expect to find at the foot of steep spurs and ridges of volcanic rock, and which have broken down from them in the ordinary course of weathering. This absence of the *corpus delicti* is a serious difficulty in the way of a speedy conclusion that the mountain was blown up by any such summary proceeding as Tomboro or Krakatoa, and indicates

the importance of further search after evidences of ingulfment.

Regarding the age of the caldera, it would be premature to offer any opinion, beyond the vague and general statement, that it is certainly many thousands of years old. There is abundant reason to hope, however, that further examination will throw some light on this question. We cannot, indeed, expect to reach any estimate of its age in terms of years and centuries; and our hope must be confined to that of fixing its relative age in terms of the geological calendar. Viewed in that relation, it may be said with equal confidence that its age is not great. C. E. DUTTON.

THE FISH-CULTURAL STATION AT GLOUCESTER, MASS.

WE are informed that it is the intention of Professor Baird, the U. S. commissioner of fisheries, now that methods and apparatus for hatching successfully the buoyant eggs of the cod, halibut, and other marine species have been devised, to prosecute the work on as extensive a scale as the means at the command of the commissioner will permit.

Gloucester, being the centre of the cod and halibut fisheries, furnishes unusual facilities for procuring an abundant supply of eggs within easy and convenient reach of the station, and has therefore been selected as the most advantageous location, for the extensive fish-cultural work with the marine species, now projected by the U. S. commissioner. The commission steamer, the Fish Hawk, thoroughly equipped for hatching-work, has been ordered to Gloucester, and will take her position in the outer harbor, at some convenient point where the anchorage is safe, the water pure and free from sediment, and of sufficient density to insure the buoyancy of the eggs during incubation.

All the usual methods for collecting eggs will be resorted to, and, in addition, it is expected to interest the fishermen themselves in the work of collecting by paying a reasonable price for impregnated eggs delivered at the station. Experimental investigations will also be made to determine the practicability of forwarding impregnated eggs from Gloucester to Wood's Holl and other stations to be hatched. The species which will chiefly engage the attention of the experts of the commission are the cod, halibut, haddock, herring, and the mackerel.

The results of the work with the halibut will be watched with special interest, both by fish-culturists and by those who are engaged in the fisheries. This fish is even more prolific than the cod-fish. Once in extraordinary abundance in Massachusetts and Ipswich bays, it has, within the memory of man, been almost exterminated in the area referred to. Have the conditions changed so as to determine the migration of the species to more congenial waters, or has man, by his direct agency in the fisheries, effected the extermination, over a given area, of a marine species of such marvellous fecundity? This is a question to which the work of the commission promises, in a few years, to furnish a satisfactory answer.

GREELY'S THREE YEARS OF ARCTIC SERVICE.

THE name and fame of Lieut. A. W. Greely of the U. S. army now belong to the history of geographical research and of undaunted heroism. The pages of this journal have so often referred to his arctic explorations that it would be superfluous to review again the thrilling incidents of his perilous voyage. The scientific world is well aware that he was sent by the U. S. government as the leader of an expedition which was to co-operate with many kindred parties in the observation of physical phenomena in the extreme north; that this arduous enterprise was not for the gratification of personal or national pride by extending the coast-lines of the northern chart, or by carrying the flag a little nearer to the pole than it had ever been borne before; that it was not for the purpose of adding renown to the army, or glory to the explorers, but to help in solving important problems in terrestrial physics by a series of exact, patient, long-continued, and carefully recorded observations in the ice-bound regions of the north.

As long ago as 1875, Lieutenant Weyprecht of the Austrian navy, who had won experience and distinction in arctic researches, succeeded in calling the attention of the civilized world to the idea that future voyages should not be planned with reference to the increase of our knowledge of geographical boundaries, but rather to the ascertainment of scientific facts, by contemporaneous observations in well-chosen stations at the north, under the concerted actions of the most experienced men and the most enlightened governments. As a result of the acceptance of this idea, fourteen stations were established by eleven co-operating nations; namely, Austria, Denmark, France, Germany, Great Britain, Holland, Norway, Russia, Sweden, and the United States. Many astronomical observatories in different parts of the globe lent their aid to the project, so that the number of

Three years of arctic service. An account of the Lady Franklin Bay expedition of 1881-84, and the attainment of the farthest north. By ADOLPHUS W. GREELY. 2 vols. New York, *Scribner*, 1886, 8°.

stations observing in concert was more than forty. Seven hundred men, in all, were exposed to the dangers of arctic life; but so skilful were the arrangements that no man perished, with the unfortunate exception of some who were connected with the Lady Franklin Bay expedition, and not they until after their appointed duties had been successfully completed. The results of all these efforts are gradually becoming the possession of the scientific world. It will take a long while to reduce the observations and to publish them in proper form, and longer still to discover the laws which are suggested by the recorded phenomena; but the work projected has been done, and well done, and mankind will reap the benefits. Whether the results are more or less, Lieutenant Greely is right in saying that the work of the International polar commission will live in history, if only as an epoch in modern civilization, marked by the union of eleven great nations in planning and executing for strictly scientific purposes so expensive and dangerous a work.

ARCTIC REGIONS, SHOWING LOCATION OF CIRCUMPOLAR STATIONS, 1881-83.

[Reproduced through the courtesy of Charles Scribner's Sons.]

For the services which were required in the Lady Franklin Bay expedition, Lieutenant Greely, although not a seaman, had some unusual qualifications. He had entered the army at the age of seventeen, and endured the privations and dangers of the civil war. After peace was established, he continued in the army as one of the officers of the signal service, and thus became expert in the kind of observations to be made at the north. His physical, intellectual, and moral qualities, as the sequel proved, were adequate to his great responsibilities, and, although disaster has cast a gloom over the close of his voyage, his conduct of the work intrusted to him deserves the highest praise; and the modest record which he has now published exhibits with great accuracy and comprehensiveness the various aspects of his expedition. His pages bear the stamp of trustworthiness. There is no boasting, no self-laudation, no concealment of the embarrassments which beset the party. There is a generous recognition of the parts which were performed by all his brave associates. There is a careful record of experiences which may be useful to other navigators. There are preliminary

announcements of the scientific work of the expedition. There is no attempt at fine writing, even in those chapters which refer to most thrilling incidents; but throughout the volume may be traced the hand of a calm, observing, fair-minded, and unostentatious lover of the truth.

In thinking of the results of the Lady Franklin Bay expedition, the popular applause will commonly be given to the bravery of Lockwood and Brainard, who in May, 1882, attained the highest latitude yet reached by man (83° 23.8′ north[1]). Lockwood, unfortunately, died before the rescue of the expedition. Brainard came home, and, after eight years' service in the ranks, remains a sergeant, when his record would have gained him a commission at once in any other service in the world.

Another important reconnaissance was accomplished by Lockwood in a prolonged tour across Grinnell Land, where a remarkable series of fertile valleys was found, in which herds of musk-oxen pasture. Over a hundred of these animals were killed, and two hundred others were seen. The glaciers of Grinnell Land are extraordinary. On the shores of Lake Hazen, Greely discovered what he believes to have been the most northerly permanent habitation of man that is known, though the inhabitants thereof have vanished.

The physical observations proposed by the Hamburg polar conference were maintained from July 1, 1881, until June 21, 1884, — forty hours before the rescue of the survivors. Observations as to atmospheric pressure, temperature, and dew-point; direction and force of the wind; quantity, kind, and movement of clouds; the aurora, and the state of the weather, — were made hourly after Fort Conger was reached. Of the magnetometer (by which the declination of the magnetic needle was noted) there were ten hourly readings, except on the 1st and 15th of every month, when the readings were much more frequent. The magnetic inclination or dip was also observed, but the instrument was so poor that the value of the record is seriously impaired. Tidal observations, which promise to be of much value, were likewise made. Great pains were taken to secure accurate observations of the pendulum as a contribution to geodesy. Air samples were secured, but abandoned on the retreat. The velocity of sound at low temperatures was noted. Each day there were 526 recorded observations, — 264 magnetic, 234 meteorological, and 28 tidal. Careful memoranda were made upon the diet of the members of the party, and upon all the circumstances which tended to keep up their health; and the chapter on hygiene and routine is by no means the least important in the volumes. Geological, paleontological, zoölogical, botanical, and ethnological facts were noted whenever there was opportunity to collect such information. On all these points the appendixes are very full.

[1] Markham's highest point in 1876 was 83° 20′ 26″.

It only remains for us to add that these volumes are printed in a most attractive manner, and that the illustrations and maps are abundant and satisfactory. In all respects the book is a credit to the author and the publishers. We purposely avoid here all comment on the cause of the sad failure to relieve at the appointed time the party, and all questions in respect to the imperfections of the outfit. There was a sad lack of thorough attention to some details, — a lack which has greatly impaired the satisfaction with which the expedition would otherwise have been regarded. But Greely and his brave comrades have borne their part nobly, and we trust that a grateful republic will ponder the words with which these volumes close, and act, through congress, before it is too late.

"No man of the party has received promotion, except such temporary advancement as my personal urging could secure. Two men, with broken health, have adventured their private fortunes; and one, a most self-sacrificing, soldierly, temperate, and loyal man, lies, as these lines are penned, helpless in a city hospital, aided by private charity, his pension not even awarded. Even the meagre allowances originally promised for arctic service have not been fully paid, and the widows of the dead are generally as yet unrecognized.

"Our great country in these days asks not in vain for its sons to venture their lives for any idea which may subserve its interests or enhance its greatness. I trust that posterity may never mourn the decadence of that indomitable American spirit which in this generation fought out to the bitter end its great civil war, and made it seem an easy thing in time of peace to penetrate the heart of Africa, to perish in the Lena Delta, to die at Sabine, or to attain the farthest north."

LONDON LETTER.

ALL friends of scientific education, as well as a wider circle, hail with the greatest satisfaction the appointment of Sir Lyon Playfair, the present president of the British association for the advancement of science, to the post which is practically minister of education under Mr. Gladstone's government, which has just been constituted. For many years Sir Lyon Playfair was chairman of committees of the house of commons, and at one time he held the position of postmaster-general in a former government. It is often re-

marked, with some justice, that in the formation of an English government, from political and party considerations, the round men get put into the square holes, and *vice versa*. In the present appointment it is pre-eminently a case of the round man being fitted into the round hole. Probably no man in the house, with the possible exception of Sir John Lubbock, M.P. for the University of London, is listened to with more respect on educational questions than Sir Lyon Playfair.

Mr. D. Morris has been appointed to the post of assistant director of the Royal gardens, Kew, as successor to Prof. W. T. Thistleton Dyer, who became director on the resignation of Sir Joseph Hooker. Mr. Morris has spent some years in Jamaica as director of the public gardens and plantations, and has brought both the gardens at Kingston, and the cinchona plantations, to a very high state of efficiency.

Two new lectureships in biology have been lately established at the University of Edinburgh. The present occupant of the natural history chair is Prof. J. Corsar Ewart, whose work in connection with the fishery board for Scotland is well known; and Mr. George Brook, who has for some time past been making investigations upon fish ova for the same board, has been appointed as lecturer upon comparative embryology. Still more recently another lectureship has been endowed by Lord Rosebery. Mr. E. J. Romanes, F.R.S., has accepted the post, and in the course of the next five years will deliver thirty lectures on the philosophy of natural history. The University of Aberdeen is losing its professor of physiology, Dr. William Sterling having been called to Owens college, Manchester, as the successor of Dr. Gamgee, who is about to devote himself to professional work in a more southern climate than that of Manchester. Mr. Gilbert C. Bourne has just returned from the Chagos Archipelago, where he has been spending the last six months in zoölogical work. He has made extensive collections of the terrestrial fauna and flora, and also of the corals, some of which are probably new, while he has also devoted some time to embryological research.

At the last meeting of the Society of telegraph engineers and electricians, a very remarkable paper was read by the president, Prof. D. E. Hughes, F.R.S., as his inaugural address, on "Self-induction of an electric current in relation to the nature and form of its conductor." The researches were made with a combination of the author's induction-balance, with a Wheatstone bridge, called an 'induction bridge.' Among the practical points resulting from these researches may be mentioned a very decided verdict in favor of the ribbon form of lightning conductor, a solid rod of iron being regarded by the author as the worst possible form. Another point hitherto little understood, but first pointed out by Mr. W. H. Preece at the Aberdeen (1885) meeting of the British association, was cleared up; viz., why, when an iron and a copper wire of equal resistance and static capacity were used for telegraphing between London and Newcastle, 278 miles, there was an increase of speed in the copper line of 12.9 per cent as compared with the iron. The discussion on this paper to-morrow evening is looked forward to with great interest. W.

London, Feb. 10.

NOTES AND NEWS.

In order to give an opportunity for definite and systematic effort by all those who believe that our birds ought to be protected, the *Forest and stream* has recently founded the Audubon society. Membership in this society is to be free to every-one who is willing to assist in forwarding any one of the three objects for which it is established. These objects are to prevent so far as possible (1) the killing of any wild bird not used for food, (2) the destruction of the nests or eggs of any wild bird, and (3) the wearing of feathers as ornaments. The work to be done by the Audubon society is auxiliary to that which is being done by the American ornithologists' union committee, and will consist largely of matters of detail, to which this committee could not attend. The management of the society for the present will be in the hands of a member of this committee. Branches of this association will be established all over the country. The work of the *Forest and stream* is only preliminary. As soon as the society shall have attained a respectable membership, and be on a firm footing, it will be turned over to its members for final organization. In order that this may take place as speedily as possible, it is hoped that all interested in bird-protection will send in for membership their own names, as well as those of any others whom they think likely to assist. To all such, free circulars containing information will be sent for distribution. Names should be sent without delay to *Forest and stream*, 40 Park Row, New York, N.Y.

—The commission appointed to consider the question of consolidating several of the scientific bureaus of the government are progressing slowly with their work, and a report is not looked for within several months. It is authoritatively learned that the signal office is the chief obstacle in the way of any proposed change, and of an early settlement of this important question. A

strenuous effort will be made by those interested in this service, to prevent a consolidation, or any curtailment of its powers. The temper of the commission is decidedly in favor of consolidating some of the scientific bureaus, and a recommendation to this effect may confidently be looked for.

— It is proposed to establish a permanent exposition in Washington, preparatory to a world's exposition in 1892 to celebrate the fourth centennial of the discovery of America.

— A bill is now before congress to extend the reports of the signal service for the relief of farmers. It is proposed to forecast "cold waves, rains, storms, and marked inclemencies" of the weather, by establishing danger-signals at telegraph-stations all over the country.

— The exploration of the ancient mounds in Manitoba promises interesting results. It appears from surveys made during the past summer that the northern limits of the mound-builders lie beyond the Red River of the North. Along this river and Lake Winnipeg, mounds were found identical in structure with the famous ones of the Ohio and Mississippi valleys.

— An act of incorporation, establishing a zoölogical society in Washington, was passed in 1870; but nothing, so far, has been accomplished toward carrying into effect the provisions of its charter. Mr. P. T. Barnum now proposes to establish a zoölogical garden there, if congress will grant the use of thirty acres of the reclaimed lands on the flats for the purpose, and the privileges vested in this society. He offers to expend $200,000 in improving and beautifying the garden.

— The mineralogical collection of Mr. C. S. Bement of Philadelphia is said, by Professor Rath of Germany, to be undoubtedly the most remarkable private one in existence. It is especially valuable for the richness and perfection of its rarer forms, and for its completeness of authentic species. It includes, according to Mr. Kunz, over 10,500 specimens.

— It appears that Columbia college was not the first to act upon the Tyndall scholarship (not 'fellowship'), as stated in the last issue of *Science*. Harvard college took action in regard to the matter nearly three months ago, and at that time appointed Mr. H. H. Brogan, of the class of 1885, as the first incumbent. He was in Europe at the time, and began his studies immediately.

— Jacob v. Tschudi, the well-known South American traveller, archeologist, and naturalist, died Jan. 25, at St. Gall, Switzerland, aged sixty-eight.

— Preparations for the international horticultural exposition at Dresden, Germany, which will be held next May, are progressing rapidly. The chief exhibition-hall will comprise nearly 24,000 square feet of space; and there will be, in addition, another building, with more than double the superficial area, to contain the more delicate plants.

— An interesting fact in connection with the trephining of an Inca skull, recently described in the Proceedings of the national museum, is recalled by Mr. J. W. Taylor of Roxbury, Mass., who states that Dr. Rink, during his travels in Labrador, recorded the story of an Eskimo family that lived near a people who built their houses of bowlders. The latter were hostile to the Eskimo, and, when they took them prisoners, they put them to death by boring a hole in their foreheads with these stones.

— The importance of bacteriological studies has been recognized by the U. S. army and medical museum by the institution of extended laboratory work in the cultivation of the various forms and varieties of these microscopic organisms. Especial pains have been taken by Dr. Billings, the curator, to introduce all the latest methods and apparatus, so that the facilities are now quite equal to those of foreign laboratories. Solid culture media only are employed, as gelatine, blood-serum, potato, bread, and agar agar; and excellent results have been attained in the culture of the principal pathogenic forms. Many specimens are on exhibition, illustrating the germs of various diseases. The chromogenic forms are seen growing upon slices of potato, and represent almost every tint of the rainbow. The value of such laboratory work at the present time is unquestionably great.

— The entire number of books published in the United States during 1885, as compiled by the *Publishers' weekly*, amounts to 4,030, a decrease of about 50 from that of 1884. In education and language there were 225, a decrease of 2; medical science and hygiene, 188, a decrease of 21; social and political science, 163, a decrease of 5; physical and mathematical science, 92, a decrease of 42; mental and moral philosophy, 25, an increase of 6. The loss has been greatest in works on science and the useful arts, and the greatest gains were on religious, theological, and juvenile works. The largest number of works, 934, as usual, were of fiction, with theological, law, and juvenile books coming next, each with about 400.

— The Museum of hygiene at Washington contains a metallic burial-casket similar to that sent to Siberia to receive the body of Captain De Long, who perished at the Lena in October, 1881. These

caskets are designed to preserve the body in nearly a natural state by excluding the air. The body is surrounded with ground cork, and the lid of the casket is carefully cemented with white lead; it is then wrapped in a layer of thick felt, and placed in a tightly constructed pine case, which is completely filled with the ground cork. The seams of the pine box are carefully covered with white lead, and the whole is enveloped in another thick wrapping of felt; over the latter is a covering of burlap, secured by stout cords; outside is a pine crate. These caskets are believed to be the best ever made for the preservation of the dead; and the great success achieved in the transportation of the remains of De Long and his companions would seem to indicate their entire feasibility for general use in similar instances, or where bodies are to be transported long distances through many climatic changes.

— The herbarium of the national museum at Washington now embraces over 25,000 specimens, representing 17,000 species, and is established upon a broad basis, which admits of almost unlimited expansion. The North American flora is represented by about 7,000 species, contributed by Ward, Canby, Havard, and others, and is constantly increasing. The herbarium is also rich in European species, the gift for the most part of the authorities at Kew, and chiefly from the collections of George Curling Joad and J. Gay. This material, however, represents only a small portion of the national herbarium, the greater part of which is yet at the department of agriculture, where the government collections were formerly deposited before the erection of the national museum building. Case-room is provided, and the specimens are permanently mounted and systematically arranged according to the system adopted by Bentham and Hooker in their 'Genera plantarum.' The collection is rendered easily accessible by means of a card catalogue, and Roman and Arabic label numbers for order and genus on each genus-cover. The herbarium is placed in immediate connection with the department of fossil plants, and under the same curatorship. It is intended that all duplicate material shall represent either additional parts of plants or widely different localities, as illustrating their geographical range, local variation, etc. Other duplicates will, however, be utilized in effecting exchanges for species not represented.

— The *Berichte der deutschen botanischen gesellschaft* contains the interesting results of a number of experiments recently made by Strasburg upon the grafting of solanaceous plants. Jimson-weed (Datura stramonium) and 'wintercherry' (Physalis alkengi) were ingrafted upon potato-stocks, with immediate union; and with the tobacco-plant less speedy though equally successful results were derived. Grafting deadly nightshade (Atropa belladonna) and henbane (Hyoscyamus niger) was accomplished with more difficulty. Other attempts also succeeded in ingrafting the potato upon the nightshade (Solanum nigrum), tobacco, and wintercherry, though with less ease. Not only were union and growth secured between these different solanaceous plants, but also between the potato and Schizanthus Grahami, a Chilian scrophularian plant, upon which the potato-fungus grows. The development in this last, however, was feeble. In none of these experiments did there appear to result any modifying influence upon the stock. The potato produced tubers as usual, though there appears to have been a greater number of irregular forms. With the jimson-weed the tubers were well developed, but no seeds were produced. On the other hand, tobacco-plants fructified abundantly, with only a sparse growth of tubers. Reserve material does not seem to be sufficient to admit of both seeds and tubers together. Potato-plants grafted on others seemed to possess a superabundance of reserve material, however, resulting in the growth of tubers of the size of a walnut, in the axils of the leaves. The 'eyes' of these tubers, it is interesting to state, developed leaves of considerable size. This growth of tubers above ground has been previously observed in the potato-plant, where the stem had been crushed close to the surface.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Sea level and ocean-currents.

ACCORDING to Zöppritz, the winds were thousands of years in overcoming the inertia of the water, and causing the present ocean-currents. Of course, during the latter part of this long period, after their effect had extended down to the bottom of the ocean, a part of their force was spent in overcoming the friction over the bottom, and toward the last a very small part only in accelerating the motion. But according to the same authority, after 239 years, while the whole force of the winds was spent upon the inertia of the water, only one-half the surface velocity was communicated to the stratum at the depth of 100 metres; and so at the depth of a few hundred metres there was yet very little velocity. The greatest surface velocities in the open sea, supposed to be due to the winds, are, on the average, not more than ten miles per day. The whole amount of momentum, therefore, caused by the action of the winds, is only about equal to that of a stratum 100 metres in depth, with a velocity of ten miles per day, the amount of momentum below 100 metres in depth being about necessary to reduce that above 100 metres to the mo-

mentum, corresponding to that of a uniform velocity of ten miles per day for all the strata. We can only judge of the force of the winds, as exerted upon the surface of the ocean, by the amount of momentum produced in a given time; and, from the small amount of momentum produced in so long a time, this force must be very small.

Let us now examine the effects of gravity as called into play by the gradients of the strata of equal pressure, arising from unequal upward expansions due to differences of temperature. Referring to my notes upon this subject, I make the following extracts from a larger table, in which the temperatures and the upward expansions are given for three stations at the given depths in the first column: —

Depths in Fathoms.	Equator.		Lat. 23°.2 N. Long. 38°.7 W.		Lat. 37°.9 N. Long. 41°.7 W.	
	Temp.	Expan.	Temp.	Expan.	Temp.	Expan.
0	25°.5C.	5.1ft.	22°.2C.	7.8ft.	21°.1C.	8.5ft.
50	17 .7	3.9	—	—	—	—
100	13 .1	3.2	19 .4	5.8	17 .5	6.7
200	8 .1	2.8	14 .8	4.6	15 .9	5.2
300	5 .7	2.4	11 .4	3.6	15 .6	4.0
400	4 .6	2.0	8 .7	2.8	12 .7	3.0
500	3 .8	1.8	6 .5	2.3	8 .2	2.3
600	4 .0	1.6	5 .4	2.0	5 .3	1.9
700	3 .9	1.4	4 .8	1.8	4 .8	1.7
800	3 .9	1.2	4 .1	1.6	3 .4	1.6
900	3 .4	1.1	4 .0	1.5	3 .2	1.5
1000	2 .7	1.0	3 .5	1.4	3 .2	1.4
1500	2 .3	0.6	2 .6	0.9	2 .7	0.9

The temperatures are the means of six soundings of the Challenger expedition, as given by Dr. Croll; and the upward expansion, computed from Dr. Hann's formula for the density of sea-water, is that arising from the differences of temperature at the different depths, and that of the maximum density of sea-water in the polar regions. The temperatures at the bottom of the stations, ranging in depth from 2,500 to 2,700 fathoms, were a little less than 2°. The upward expansion of the surface at the equator is a little greater than that of Dr. Croll (4.5 feet), obtained by means of Muncke's tables, but the difference is of no consequence.

It is seen that the temperatures and upward expansions diminish rapidly near the surface, and that the latter are small in the lower depths. Supposing, for simplicity, that the gradients are uniform from the equator to the latitude of maximum density, say 5,000 miles from the equator, then the average gradient of the whole mass of the ocean, down to the depth of 2,500 fathoms, is about 1.5 feet in 5,000 miles, instead of 5.1 feet, as at the surface. The force, therefore, down this average gradient, of the whole mass, is to that of gravity about as unity is to 18,000,000. It is readily found, from computation, that this force down this small gradient would give to the whole mass, in four days, a velocity of ten miles per day. According to Zöppritz, the whole action of the winds in 239 years produced only this amount of velocity on a surface stratum of 100 metres in depth, say one-fiftieth part of the whole depth. To produce an amount of momentum, therefore, equal to that of the whole ocean, with a velocity of ten miles per day, would require nearly 12,000 years. Comparing, now, four days with 12,000 years, we get an approximate idea of the relative strengths of the two forces, for these must be inversely as the times required to produce a given amount of momentum. The force of the winds upon the ocean, therefore, in comparison with the gravitation force, is almost infinitely small, if Zöppritz's results are to be accepted. But I have never accepted these, and therefore regard this simply as a very strong *argumentum ad hominem* on the subject to anyone who accepts them, and also maintains that the winds have any sensible effect in causing ocean-currents. Of course, a very small force, with time enough, will produce any given amount of momentum; and so the winds, in time, could have caused an amount of motion equal to that observed in the ocean, if no other forces had been in operation; but with other forces many times greater, causing both vertical and horizontal circulations, of course the effects of the infinitely small force would be entirely lost.

In the flowing of rivers down a gradient, knowing the gradient and the mass, we have a measure of the force required to overcome the friction; and thus, from the known depth and velocity, it is easy to obtain approximately the value of the friction-constant. From any considerations of this kind I have never been able to obtain a friction-constant nearly so small as that assumed by Zöppritz, and therefore think it is many times too small as applied to rivers or ocean-currents.

If we assume that the winds can cause the given amount of momentum in one year, instead of 12,000, we still have their force upon the ocean nearly 100 times less than the gravitation force; and I think good judgment in the matter would decide that a year, at least, would be required for the slight action of the gentle winds blowing over the ocean to give an amount of momentum equal to that of the whole mass, with a velocity of ten miles per hour. I cannot think, therefore, that the effect of the winds is more than one-hundredth part of that of the gravitation force.

Professor Davis seems to think that the gravitation force is too small, even allowing it a long time to act, to move the whole mass of the ocean. But the greatest tidal gradients with reference to the resultants of gravitation and lunar forces, are little, if any, greater than that of fifteen feet in 5,000 miles; yet these move the whole mass of the ocean to the bottom back and forth twice a day, causing regular elevations and depressions of the surface, now high water, and six hours after, low water. The maximum tidal velocities for all depths amount to a velocity of nearly a mile per day. I do not think a quarter-diurnal reversal of the directions of the winds would give rise to reversed velocities of that amount to a stratum of the depth of ten metres; and so the effect of the winds would be about 150 times less than that of the tidal forces, which are about the same as those of the gradients arising from the differences of temperature.

The regular gradients from the equator to the polar regions must be regarded as the initial ones, and consequently the forces arising from them, as the forces which overcome the inertia of the water before the final motions have been fully established. But the directions of the initial motions are very much modified by the deflecting forces of the earth's rotation, and the distribution of the temperature disturbances somewhat changed. An interesting example of this kind is indicated by the temperatures of the last two stations of the preceding table, from which it is seen, that, in the region of the Sargossa Sea, the high temperatures extend down to greater

depths, and the consequent upward expansions are greater. This is caused by the gyratory motion of the water around this region. The deflecting force of the earth's rotation arising from this motion, being on all sides to the right of the direction of motion, drives the surface water, together with the seaweed from all sides, into this region; so that there is a little heaping-up of the water in this region above that caused by the greater upward expansion: and this causes a settling-down and a flowing-out at all sides below, where the gyratory velocity, on account of greater friction, is less, and the consequent inward pressure toward the central part less, than they are above. This carries the warm surface water downward, and makes the average temperature for all depths and the upward expansion greater here than in the surrounding parts; and this, together with the slight accumulation of the mass in the region of the Sargossa Sea, raises its level several feet.

Where wind drives the water against a barrier or shore, as in the case of Lake Ontario or the Atlantic Ocean, regular progressive currents from top to bottom in the same direction cannot be established; but the surface water which is driven forward must return below, or at the sides if the wind blows over the middle part only. In such cases the greatest change of sea-level takes place soon after the winds begin to blow in any given direction, while the whole force is spent upon a comparatively thin stratum. It is well known that winds blowing over a very shallow stratum of water, or along the length of a very shallow canal, may produce a considerable change of level; whereas, if the depth were considerable, the change would be but little. At first, while the whole force of the wind is spent upon the surface water of a lake or ocean, the great body of undisturbed water below is the same as so much solid matter. But after the surface water has been driven to one side, and the pressure there increased, which gives rise to the return current below,— when this has been fully established, the difference of sea-level at the two sides or ends, from and to which the wind blows, is less.

W. Ferrel.

Washington, D.C., Feb. 12.

The Davenport tablets.

Please allow me to trouble you once more, and finally, in reference to the Davenport tablets.

Mr. Putnam says, "If Professor Thomas will take the Grave Creek tablet, or even the famous Rosetta stone, and sit down before them with his Webster's 'Unabridged,' he will find no end of similar resemblances." Very true, as the alphabets used on the Rosetta stone are some of those given by Webster, and the characters on the Grave Creek tablet have been taken from half a dozen different alphabets, which is one of the chief reasons why it is generally rejected by modern archeologists (see Dr. Wilson's scathing criticism in his 'Prehistoric man,' third edition, vol. ii. pp. 99–111).

Mr. Putnam's criticism of Mr. Tiffany's letter, on account of illiteracy, is in strange contrast with the records of the Davenport academy, which show that Mr. Tiffany was one of its four original organizers (Proc., vol. vi. p. 1), was a member of the museum committee, was one of the board of trustees named in the constitution and articles of incorporation, was a member of the committee on finance (Proc., vol. i. pp. 4, 7, and 8), was more than once selected as one of a committee of three to draught resolutions (Proc., vol. i. pp. 23 and 71), was one of a committee of two appointed to take steps toward erecting a building, was for some years treasurer of the academy (Proc., vol. i. p. 67), and did considerable mound-exploring, for which special credit is given in the president's annual address of 1876.

It is true that in the letter, from which I quoted only so much as touched upon the points then under discussion, Mr. Tiffany expresses entire confidence in the shale tablets, which is proof that his expression of doubt in regard to the 'limestone tablet' was not for the purpose of 'defaming his old associates,' but because the evidence satisfied him it was a plant.

In answer to Mr. Putnam's singular philosophy respecting the entrance of water into the little vault where the limestone tablet was found, it is only necessary to refer to the figure and description of mound 11, heretofore given. As neither cement, plastering, clay, nor mortar was used, it would have been, as every mound-explorer knows, a miracle if water had failed to enter the vault, and, in the course of centuries, fill it with dirt. Moreover, in the course of time the superincumbent weight would have pressed the slab which covered the vault down upon the tablet.

Archeologists, so far as they have spoken, have, almost without exception, indicated in their published works a want of faith in these tablets. Short, in his 'North Americans of antiquity' (p. 40), says, "The above conjectures as to the significance of the representations on these tablets are based upon the supposition that they are genuine, and not the work of an impostor, *of which we cannot refrain from expressing a slight suspicion*." Rev. J. P. MacLean, speaking of the cremation scene, says, "Among the cabalistic characters, the word 'town' stands out in bold lines, and the figure '8' appears in rude shape among other marks. The picture of a face occurs in the sun, resembling the face of a European. The artist has overdone his work: *it needs no further investigation*" ('Mound-builders,' p. 116). Yet Mr. MacLean is one of two (Dr. Willis De Haas is the other), of whom Mr. Putnam remarks in his recent annual address to the academy, as published in the local papers, "There are thus no more competent archeologists in the country." Mr. Peet, in the *American antiquarian* of July, 1878, expresses the same opinion as Mr. MacLean. Prof. M. C. Read, in the *American antiquarian* of April–July, 1882, expresses a doubt as to their authenticity, based upon the characters they bear. Dr. E. Schmidt, in an article entitled 'The mound-builders and their relation to the historical Indians' (*Kosmos*, 1884, p. 146), remarks, "It is hardly necessary to be pointed out that none of the notorious tablets are without suspicion, and that all which have been subjected to earnest investigation have turned out to be gross forgeries." It appears from these notices that I am not alone in expressing doubt as to the authenticity of these tablets.

Notwithstanding the kind invitation of the academy to visit their museum and inspect the tablets, I preferred, for the present, to base my arguments on the publications of the academy (the albertypes included) and the statements of its members, as this avoided recourse to personal judgment, and appealed only to what is before the public. Even the extracts from Mr. Tiffany's and Mr. Pratt's letters were in

confirmation of Mr. Harrison's published account of the finding of the limestone tablet. If this evidence leads to the conclusion that these relics are modern productions, as I believe it does, there is no necessity for the present of 'further investigation,'—a conclusion Mr. MacLean seems to have reached while writing his 'Mound-builders.' CYRUS THOMAS.

The claimed wheat and rye hybrid.

In *Science* of Jan. 15 appears an article from Dr. Sturtevant, which, to save words, I will call a criticism of an account of my rye and wheat hybrids, published in the *Century magazine* of last January by Charles Barnard. Mr. Barnard, after an examination of the plants at my place last summer, gives their history, accepting, without question, their hybrid origin. Dr. Sturtevant, who also examined them last summer, begs to dissent. He considers the evidence adduced only 'sufficient to establish grave doubts.'

While we were on our way to the plots, Dr. Sturtevant remarked that he wanted me to know that he was 'incredulous as to the whole thing.' While we were returning, he said, "I am convinced that they are hybrids, but I question whether they will not be found to be distinctly either wheat or rye." In the *Science* article referred to, he next states that he has compared the pictures of a few of these heads which appeared in the *Rural New-Yorker* with those of five old varieties which he mentions, and finds them closely alike. Then he remarks that he does not question the 'attempt at a cross.' The 'variability effected is,' he admits, 'indicative of a foreign pollen.' This variability, which he believes not to be due to hybridization, the doctor explains by an 'hypothesis.' It is that under the stimulus of the rye pollen, atavism has resulted, whereby varieties dormant in the wheat (female) plant have made their appearance. Finally he expresses the hope that some one, expert in agricultural botany, may 'investigate a series of these specimens.'

Dr. Sturtevant, though he states that he has carefully studied the 'published claims,' has apparently overlooked the published fact that specimens of these hybrids have been sent to no less than six well-known botanists, several of whom have replied that they were evidently hybrids, while others replied to the effect that the hybridization was a most interesting fact, etc.

Now, if we emasculate the florets of a head of wheat while the anthers are immature, and repeatedly apply rye pollen, and thus succeed in attaining ten grains, from which, in three years, at least fifty different varieties appear, differing as widely as any known wheats differ from each other, while some of them resemble rye more than wheat, can anyone reasonably doubt that a hybridization was effected? Why assume any thing else whatever? What does Dr. Sturtevant mean by ascribing such changes to the 'stimulus of foreign pollen' as something different from the sexual effect of foreign pollen? Suppose atavism is shown in some of these: does it not prove, all the same, that hybridization was effected? A hybrid may show all, some, or none of the characteristics of either parent, and still be a hybrid, as has often been revealed in the later seedling progeny.

In drawing resemblances between the pictures in the *Rural New-Yorker* and those of which he speaks, the doctor, very likely, forgets an important fact; viz., that in many of the heads of the plants most resembling rye, the spikelets bear but two kernels, while many are wholly abortive. Again: the botanical relationship is marked not only by narrower glumes, by fewer florets and grains, but by the fact that the culms beneath the head for an inch or so are hairy,—a characteristic that never occurs on wheat culms. The color of both the culms and leaves is also distinctly lighter (more glaucous) than that of wheat, and the habit of the young plant is that of rye. E. S. CARMAN.

A recent ice-storm.

The trees in central Massachusetts, along the line of the Boston and Albany railroad from Worcester to Spencer, suffered severely from the weight of ice formed upon them during the storm of Feb. 11–13, that caused the recent destructive floods. It was noticeable that the trees which exposed the largest surface for the attachment of ice did not suffer most: the pines with their green needles, and the oaks with their dead leaves, generally escaped injury; and the slender birches were saved by bending instead of breaking. But from five to twenty per cent of the other deciduous trees were more or less hurt. The side limbs were not often broken: it was nearly always the vertical top-stems that sustained the most injury, apparently because their natural position was farthest from that into which the weight of the clinging ice forced them.

Can some of your readers furnish direct observational evidence to show why the pines and leafy oaks escaped, while the bare trees were so much damaged?

W. M. DAVIS.

Cambridge, Feb. 20.

Corrections of thermometers for pressure.

If any of your readers interpreted our reference in *Science*, Feb. 12, to a letter from the signal office, as your correspondent, Sig., feared they might do, we regret it, and are glad that the import of that letter has been fully explained. We are well aware that many of our text-books on heat refer to the effect of pressure on the thermometer, and state how to prevent it in some instances. The effect of appreciable changes of pressure on the thermometer seemed to us to be sufficient to demand correction in all accurate thermometric work. If such corrections are generally made, they are omitted in the report of experiments.

F. P. VENABLE.
J. W. GORE.

University of North Carolina, Feb. 22.

Is the dodo an extinct bird?

Referring to Dr. Shufeldt's article (*Science*, vii. 145) respecting the supposed present existence of the dodo, it may be desirable to state, for the benefit of those who are not already aware of the fact, that the so-called dodo from Samoa, mentioned in the clipping 'from an English newspaper,' is not the dodo at all, but the dodo-pigeon, Didunculus strigirostris, a living specimen of which was last year presented to the national museum by Dr. T. Canisius, ex-consul of the United States at Samoa. This specimen was, at latest account, thriving in the zoölogical garden at Philadelphia. ROBERT RIDGWAY.

Smithson. inst., Feb. 15.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 26, 1886.

THE PRESENT WHOLESALE DESTRUCTION OF BIRD-LIFE IN THE UNITED STATES.

In the bird-world, as elsewhere, the struggle for existence, even under natural conditions, is a severe one, undue increase being held well in check. Birds, and their eggs and young, are not only the natural prey of many predaceous mammals and reptiles, but also of predaceous birds. Squirrels, spermophiles, and mice, although not in a strict sense rapacious, are among the worst natural enemies of the smaller birds, whose eggs and young they seek and devour with avidity; while many birds not usually classed as predatory, as the jays, crows, grackles, cuckoos, and some others, wage unremitted warfare upon the eggs and young of the weaker species. The elements are also far more destructive of bird-life than is commonly recognized. Late cold storms in spring destroy many of the early migrants, sometimes nearly exterminating certain species over considerable areas where they had become prematurely settled for the season. The unusual southward extension of severe cold waves and heavy snow-falls, such as have marked the present winter, are destructive to the bird-life of the regions thus exceptionally visited. During the migrations, both in the fall and spring, immense numbers of birds are sometimes caught by storms, and blown far out to sea and drowned, or perish in attempts to cross the larger inland lakes. There is abundant evidence to show that the annual destruction of birds by the elements alone must prove a severe check upon their increase. But all this is a part of nature's routine, which has characterized past ages as well as the present, and which, so far as we know, may be only the natural and necessary check upon undue increase. It is only when man comes upon the scene that nature's balance is seriously disturbed.

Man's destructive influence is to some extent unavoidable, but in far greater part selfish and wanton. The removal of forests, the drainage of swamps and marshes, the conversion of wild lands into farms, and the countless changes incident to the settlement of a country, destroy the haunts and the means of subsistence of numerous forms of animal life, and practically result in their extermination over vast areas. The birds, particularly the larger species, suffer in common with vertebrate life in general. Electric-light towers, light-houses, and light-ships are also a fruitful and modern source of disaster to birds, particularly during their migrations, when, in thick weather, thousands upon thousands kill themselves by dashing against these alluring obstructions. Telegraph-wires contribute also largely to the destruction of bird-life. While the destruction by these agencies is greatly to be regretted, it is not directly chargeable to cupidity and heartlessness, as is the far greater slaughter of birds in obedience to the dictates of fashion, presently to be detailed.

The history of this country, as is well known, is the record of unparalleled destruction of the larger forms of animal life. Much of this destruction, it is true, was unavoidable, sooner or later. But it is no less true that the extirpation of our larger game animals has been needlessly hastened by what may be fairly termed a disgraceful greed for slaughter, — in part by 'pot-hunting' on a grand scale, in part for the mere desire to kill something, — the so-called 'love of sport.' The fate of extermination, which, to the shame of our country, has already practically overtaken the bison, and will sooner or later prove the fate of all of our larger game-mammals and not a few of our game-birds, will, if a halt be not speedily called by enlightened public opinion, overtake scores of our song-birds, and the majority of our graceful and harmless, if somewhat less 'beneficial,' sea and shore birds.

The decrease in our song and shore birds is already attracting attention; and the protest against it, which reaches us from many and widely distant parts of the country, is not only painful evidence of this decrease, but gives hope that the wave of destruction, which of late years has moved on in ever-increasing volume, has at last reached its limit of extension, and that its recession will be rapid and permanent. But to secure this result, the friends of the birds — the public at large — must be thoroughly aroused as to the magnitude of the evil, and enlightened as to its causes and the means for its retrenchment. It is therefore the purpose of the present series of papers to throw some light upon the extent, the purposes, and the methods of the present wholesale slaughter of our native birds.

Birds are killed for food, for 'sport,' for natural-

history specimens, to stuff as objects of curiosity or ornament, and for personal decoration. The birds killed for food are, of course, mainly the commonly so-called game-birds, — pigeons, grouse of various kinds, ducks and geese, and the great horde of smaller waders, known as 'peeps,' snipes, plovers, rails, etc. The slaughter of these has been so improvident, and their decrease of late so marked, that they are now more or less cared for by the numerous game-protective associations, but are still, in the main, very inadequately guarded. In addition to the birds commonly recognized as game-birds, many song-birds are hunted for food, notably the reed-bird, or bobolink, the robin, the meadow-lark, the blackbird, and the flicker, and, in some localities, all the larger song-birds. This is particularly the case in portions of the south, where strings of small birds may be seen suspended in the game-stalls. In March of last year, a well-known ornithologist reports finding in the market at Norfolk, Va., hundreds of woodpeckers and song-birds exposed for sale as food, the list of species including not only robins, meadow-larks, and blackbirds, but many kinds of sparrows and thrushes, and even warblers, vireos, and wax-wings. While some of the stalls had each from three hundred to four hundred small birds, others would have but a dozen or two. "Nearly all the venders were colored people, and doubtless most of the birds were captured by the same class." This 'daily exhibition in southern markets' indicates an immense destruction of northern-breeding song-birds which resort to the southern states for a winter home.

As shown in a subsequent paper of this *Supplement*, the eggs of many species of terns, gulls, plovers, and other marsh and shore breeding species, are systematically taken for use as food, the egg-hunting business being prosecuted to such an extent as to prove a serious cause of decrease of the species thus persecuted, while the value as food, of the eggs thus destroyed, is too trivial to be for an instant regarded as of serious importance. The havoc described below by Mr. Sennett as wrought in Texas prevails all along our coast-lines; and many localities might be cited where the destruction is equally sweeping, as on the Pacific coast and at frequent points on the Atlantic coast from Florida to Labrador, — wherever, in fact, the birds occur in sufficient numbers to render such wholesale plundering practicable. The marsh-breeding rails are at some localities subject to similar persecution. At one locality on Long Island, I am informed, a 'bay-man,' who keeps a house of entertainment for sportsmen during 'the season,' supplies his table for weeks at a time with the eggs of the rails that breed numerously in his vicinity, — in strange conflict, too, with his own interests, since, by destroying the eggs of the rails, he 'kills the goose that lays the golden egg' for the rail-shooting season.

In general, the game and quasi-game birds are killed for sport rather than for gain or for their intrinsic value as food: exception, however, is to be made of the 'professional' or 'market' gunners, by whom the ranks of the water-fowl are so fearfully thinned, and who often resort to any wholesale method of slaughter their ingenuity may be able to devise. But the slaughter of our birds in general is doubtless largely due to the mere fascination of 'shooting.' Many song-birds are killed 'for sport' by the 'small boy' and the idler, whose highest ambition in life is to possess a gun, and whose 'game' may be any wild animal that can run or fly, and wears fur or feathers. Some slight depredation on the small fruits of the garden, or on field-crops, is ample pretext for a war of extermination on robins, catbirds and thrashers, jays and chewinks, as well as blackbirds and crows, and the birds so unfortunate as to fall into the category of hawks and owls, notwithstanding the fact that every one of these species is in reality a friend. Yet the slaughter is winked at, if not actually encouraged, by those who are most injured by it; while the 'general public' of the districts where such practices prevail are either too ignorant of the real harm done, or too apathetic, to raise any serious protest.

Among the important agencies in bird-destruction is the 'bad small boy' — and in the ornithological sense his name is legion — of both town and country. Bird-nest robbing is one of the besetting sins — one of the marks of 'natural depravity' — of the average small boy, who fails to appreciate the cruelty of systematically robbing every nest within reach, and of stoning those that are otherwise inaccessible. To him the birds themselves, too, are also a fair target for a stone, a sling, a catapult, or a 'pea-shooter:' to the latter many a sparrow, a thrush, or warbler falls a victim. Says a recent writer on the subject of bird-destruction, "Two ten-year-old lads in that quiet and moral hamlet [Bridgehampton, Long Island] confessed this autumn, that with pea-shooters they had killed during the season fifty robins and other birds which frequent the gardens, orchards, and cemetery. Such boys exist all over the United States, and war on birds as things made to be killed. . . . The pea-shooter gives no sound, and can be carried in the vest-pocket; but so destructive is it in the hands of a skilful child, that the legislatures of some of the western states were obliged to pass laws making

the sale of the thing a misdemeanor, and punishing the possession or use of it."

Perhaps equally, possibly more destructive, and certainly more reprehensible, is the newly-arrived 'foreign-born citizen,' who, to demonstrate to himself that he has really reached the 'land of the free,' equips himself with a cheap shot-gun, some bird-traps, clap-nets, or drugged grain, one or all, and hies himself to the nearest haunt of birds for indiscriminate, often very quiet, slaughter or capture. Of course, only a few of our guests from foreign shores either possess or indulge in this propensity; but in the neighborhood of our larger cities, notably on Long Island, and elsewhere near New York, the destruction of bird-life thus effected, we are credibly informed, is startlingly large.

The destruction of birds by taxidermists, and for alleged 'scientific purposes,' has justly attracted attention, and has unjustly brought into disrepute the legitimate collecting of both eggs and birds for scientific use; but much of this alleged scientific collecting is illegitimate, being really done under false colors, or wrongly attributed to science. Of the birds killed or mounted by taxidermists, some, not unfrequently a large part, are for museums or private cabinets: another large share is put up for parlor or hall ornaments, either as groups or singly. All this, by a little license, may be allowed as legitimate, or at least not seriously reprehensible. But, unfortunately, the average taxidermist has too often an unsavory alliance with the milliner, and, in addition to his legitimate work, is allured into catering on a large scale to the 'hat-trade.' Although a few of them are too high-principled and too much the naturalist at heart, to thus prostitute their calling, taxidermists as a class are at present in deserved disrepute, and are to a large degree responsible for much of the public and mistaken criticism of scientific collecting. This criticism is perhaps more especially directed against the 'egg-collector,' who ranges in calibre and purpose from the schoolboy, who gathers eggs as he does postage-stamps or 'show-cards,' — for the mere purpose of 'making a collection,' — to the intelligent oölogist or ornithologist, who gathers his eggs in sets, prepares them with great care, with the strictest regard to correct identification, and in series sufficient to show the range of variation — often considerable — in eggs of the same species, and takes a few additional sets for exchange. He may have in the aggregate a large collection, numbering hundreds of species, and thousands of specimens; but in general the same species is not laid under serious requisition, and the sets are gathered at considerable intervals of time and from a large area of country. A squad of street-urchins set loose in the suburbs will often destroy as many nests in a single morning's foray as a collector gathering for strictly scientific purposes would take in a whole season, and with far more harmful results, because local and sweeping. Much of the egg-collecting by schoolboys should be stopped, and can be easily checked under proper statutory regulations, as will be explained later in a paper on bird-legislation.

The scientific collector, as already intimated, is charged, in some quarters, with the 'lion's share' of the responsibility for the decrease of our song-birds: with what justice, or rather injustice, may be easily shown, for the necessary statistics are not difficult to obtain. The catalogue of the ornithological department of the national museum numbers rather less than 110,000 bird-skins. This record covers nearly half a century, and the number of specimens is four times greater than that of any other museum in this country; while the aggregate number of all our other public museums would probably not greatly exceed this number. But to make a liberal estimate, with the chance for error on the side of exaggeration, we will allow 300,000 birds for the public museums of North America, one-half of which, or nearly one-half, are of foreign origin, or not North American. To revert to the national museum collection, it should be stated, that, while only part of the specimens are North American, — say about two-thirds, — they represent the work of many individuals, extending over a third of a century, and over the whole continent, from Alaska and Hudson Bay to Mexico and Florida, and from the Atlantic to the Pacific. Furthermore, this number — 110,000, more or less — is not the number now in the national collection, which is far less than this, thousands and thousands of specimens having been distributed in past years to other museums in this country and abroad.

So far the public museums: now in relation to private cabinets of bird-skins. Of these it is safe to say there are hundreds scattered throughout the country, containing from three hundred to five or six hundred specimens each, with a few, easily counted on the fingers of the two hands, if not on a single hand, numbering five or six thousand each, with possibly two approaching ten thousand each. Probably 150,000 would be a liberal estimate for the number of North American bird-skins in private cabinets, but, again to throw the error on the side of exaggeration, let us say 300,000, — not, however, taken in a single year, but the result of all the collecting up to the present time, and covering all parts of the continent. Add this number to the number of birds in our

public museums, less those of foreign origin, and we have, allowing our exaggerated estimates to be true, less than 500,000 as the number of North American birds thus far sacrificed for science. The few thousand that have been sent to other countries in exchange for foreign birds can safely be included under the above estimate, which is at least a third above the actual number.

We have now passed briefly in review all the agencies and objects affecting the decrease of our birds, save one, and that the most important — many times exceeding all the others together, — the most heartless and the least defensible, namely, the sacrifice of birds to fashion, for hat ornamentation and personal decoration. Startling as this assertion may seem, its demonstration is easy.

In this country of 50,000,000 inhabitants, half, or 25,000,000, may be said to belong to what some one has forcibly termed the 'dead-bird wearing gender,' of whom at least 10,000,000 are not only of the bird-wearing age, but — judging from what we see on our streets, in public assemblies and public conveyances — also of bird-wearing proclivities. Different individuals of this class vary greatly in their ideas of style and quantity in the way of what constitutes a proper decoration for that part of the person the Indian delights to ornament with plumes of various kinds of wild fowl. Some are content with a single bird, if a large one, mounted nearly entire: others prefer several small ones, — a group of three or four to half a dozen; or the heads and wings of even a greater number. Others, still, will content themselves with a few wings fancifully dyed and bespangled, or a wreath of grebe 'fur,' usually dyed, and not unfrequently set off with egret-plumes. In the average, however, there must be an incongruous assemblage made up of parts of various birds, or several entire birds, representing at least a number of individuals. But let us say that these 10,000,000 bird-wearers have but a single bird each, that these birds may be 'made over' so as to do service for more than a single season; and still what an annual sacrifice of bird-life is entailed! Can it be placed at less than 5,000,000? — ten times more than the number of specimens extant in all our scientific collections, private and public together, and probably a thousand times greater than the annual destruction of birds (including also eggs) for scientific purposes.

Fortunately, perhaps, the supply of bird-skins for decorative purposes is not all drawn from a single country, the whole world being laid under tribute. The ornithologist recognizes in the heterogeneous groups of birds on women's hats, met with on every hand, a great preponderance of North American species; but with them are many of the common birds of Europe, and a far greater variety from South America, and many from Africa, Australia, New Guinea, and India. But, on the other hand, it is well known that our own birds are exported in immense numbers to Europe; but, whether the exportation exceeds the importation, it is impossible to determine, from lack of proper statistics.

With the foregoing facts before us in regard to the annual destruction of our birds, it is no longer surprising that many species, and even genera, of birds, are fast disappearing from our midst. Considering that this slaughter has been waged for years, but with rapid increase year by year, is it not rather a wonder that so many birds are still left?

The extent to which this destruction is carried on, and in what ways, in the immediate vicinity of New York, is indicated in a subsequent article of this series, by Mr. Dutcher. But the slaughter extends in greater or less degree throughout the country. The destruction of 40,000 terns in a single season on Cape Cod for exportation, a million rails and reed-birds (bobolinks) killed in a single month near Philadelphia, are facts that may well furnish food for reflection. The swamps and marshes of Florida are well known to have recently become depopulated of their egrets and herons, while the state at large has been for years a favorite slaughter-ground of the milliner's emissaries. The present winter parties organized and equipped in this interest are said to be prosecuting the same wholesale warfare against the birds at various points along the whole gulf-coast.

But why, some may be supposed to ask, should the slaughter be interfered with? Does it not yield profit to many an impecunious idler, who receives so much per head from the 'taxidermist' for the freshly killed bird? Do not their preparation and manufacture into the gaudy or otherwise untasteful hat-gear give employment to many a needy hand, and add materially to the milliner's gains? Why is not their use for personal decoration, *à la sauvage*, as legitimate and defensible as their use for food, with the added advantage of being able to utilize decoratively a great many species otherwise of no commercial value? Why should we be anxious to preserve our birds? Are they, when alive, of any practical value, or do they contribute in any way to our pleasure or well-being?

In regard to the first of these inquiries, the men and boys really get little more in the average for the raw material than enough to pay them for their powder and shot: it is the 'sport' that

affords them their real reward. The middle-men, — the skinners and manufacturers, — and an occasional professional gunner, make most of the profit, which must be more or less considerable to induce them to run the gauntlet of public opinion and the occasional risks of prosecution in their illegal enterprises. The milliner shares, of course, in the profits of the trade in such supplies; but, if birds were not used to such an extent, other and more fitting decorations would be adopted in their place, and their business would not suffer.

Respecting the latter inquiries, birds may be said to have a practical value of high importance and an aesthetic value not easily overestimated. Birds in general are the friends of man, and it is doubtful whether a single species can be named which is not more beneficial than harmful. The great mass of our smaller birds, numbering hundreds of species, are the natural checks upon the undue multiplication of insect-pests. Many of them rarely make use of other than insect-food, while all, as shown by scientific investigations already made, depend largely or wholly, during considerable periods of the year, upon an insect-diet. Even the ill-reputed hawks and owls prey upon field-mice, grasshoppers, and other noxious insects or vermin, some never molesting the farmer's poultry, and others only exceptionally. In the present general summary of the subject, it may be sufficient to say, that, while the beneficial qualities of birds vary widely with the species, none can be set down as proven to be unmitigatedly injurious. With the decrease of birds at any point is noted an increase of insects, especially of kinds injurious to agriculture. The relation of birds to agriculture has been studied as yet but imperfectly; but results could be cited which would go far to substantiate the above statement of their general utility. It is a matter for congratulation, that the investigation of the subject has now been systematically entered upon by the department of agriculture at Washington, under the supervision of experts especially fitted for the work.

Birds, considered aesthetically, are among the most graceful in movement and form, and the most beautiful and attractive in coloration, of nature's many gifts to man. Add to this their vivacity, their melodious voices and unceasing activity, — charms shared in only small degree by any other forms of life, — and can we well say that we are prepared to see them exterminated in behalf of fashion, or to gratify a depraved taste? Says a recent writer, "A garden without flowers, childhood without laughter, an orchard without blossoms, a sky without color, roses without perfume, are the analogues of a country without song-birds. And the United States are going straight and swift into that desert condition."

Indeed, as previously noted, there is already an encouraging recognition of that fact. Here and there bird-protective associations are being formed, and more care is taken to secure proper bird-protective legislation; but the public at large is still too apathetic, or too ignorant of the real state of the case, to insist upon, and support by proper public sentiment, the enforcement of legislative acts already on our statute-books. The American ornithologists' union has moved in the matter by the appointment of a large and active committee on bird-protection, which is at present bending its energies toward the diffusion of information among the people, in the hope of awakening a healthy sentiment on the subject, and is also working to secure not only more effective and intelligent legislation, but the proper enforcement of the laws enacted in behalf of birds. This, too, notwithstanding a recent writer in a popular magazine characterized ornithologists as being among the worst enemies birds have, and to whose egg-collecting and bird-stuffing propensities was principally attributed the woful decrease of our song-birds!

In England the same rage for hat decoration with dead birds has gone so far that anti-plumage-wearing societies have already been established by the more intelligent women of that country; and it has already been suggested, apparently independently of any similar action abroad, by ladies themselves, that the women of this country throw their influence in a similar way against the barbarous custom of using birds for personal decorations. Much could doubtless be done in behalf of the birds in this way; for, once let it come to be considered vulgar and in 'bad form' to thus decorate one's person, and the power of fashion would be a mighty weapon in defence of the birds.

Of all the means that may be devised for checking the present wholesale bird-slaughter, the awakening of a proper public sentiment cannot fail of being the most powerful. Without this, all other means would prove, to a great degree, ineffectual. Laws, however good, cannot be enforced unless backed by public opinion. To arouse this, it seems only necessary to enlighten the community respecting the nature, the enormity, and the leading cause of this great evil. The following articles are intended to amplify and elaborate points merely hinted at in this general statement — to give a bill of particulars for certain special localities, and of certain phases, of this great slaughter of the innocents, and to show the methods adopted by some of the miscreants engaged in it.

J. A. ALLEN.

DESTRUCTION OF BIRDS FOR MILLINERY PURPOSES.

IT is difficult to gather the actual statistics of bird-slaughter for millinery purposes, since it can be done only at the expense of much time and labor. We see on every hand — in shop-windows, on the street, in the cars, and everywhere where women are seen — evidence of its enormous extent. We know also that it is carried on more or less almost everywhere, but especially in the neighborhood of the larger cities, or at points within easy access from them, and also at various distant points, which are visited by the millinery taxidermists or their agents for the express purpose of supplying the demands of the hat-trade in bird-skins. At present only a few specific details can be given, relating to only a few localities; but these may be taken as illustrative of what actually occurs at many points, respecting which the facts are known only in a general way. For many of the data here given, we are indebted to statements published from time to time in *Forest and stream*, the well-known New York weekly journal devoted to field-sports and natural history. In an editorial on 'The destruction of small birds,' published a short time since (March 6, 1884), occurs the following: "We know, for example, of one dealer . . . who, during a three-months' trip to the coast of South Carolina last spring, prepared no less than 11,018 bird-skins. A considerable number of the birds killed were, of course, too much mutilated for preparation, so that the total number of the slain would be much greater than the number given. The person referred to states that he handles, on an average, 30,000 skins per annum, of which the greater part are cut up for millinery purposes." The same article, in referring to the destruction of birds for millinery purposes on Long Island, states, that, during the short period of four months, 70,000 were supplied to the New York dealers from a single village.

A writer in the Baltimore *Sun*, of about the same date, gives some account of the destruction of birds at Cobb's Island, on the coast of Virginia. He says, "An enterprising woman from New York has contracted with a Paris millinery firm to deliver during this summer 40,000 or more skins of birds at forty cents apiece. With several taxidermists she was carrying out the contract, having engaged young and old to kill birds of different kinds, and paying them ten cents for each specimen not too much mutilated for millinery purposes. . . . The birds comprised in this wholesale slaughter are mainly the different species of gulls and terns, or sea-swallows, of which many species in large numbers could formerly be found upon this island. But now only few of these graceful birds remain upon Cobb's Island itself; and the pot-hunters, or rather skin-hunters, have to go to some distance to carry out their cruel scheme. If we consider, that, with each old bird killed,— and only old birds have a suitable plumage,— also many of the young birds, still unable to take care of themselves, are doomed to starvation, this wholesale slaughter becomes still more infamous and criminal."

Cobb's Island was formerly one of the most noted resorts of the terns, smaller gulls, and other shore-breeding birds along our whole coast; but recent visitors to the island report that the once populous colonies of these birds have been almost completely exterminated by the wholesale slaughter referred to by the writer of the foregoing extract.

Similar butchery has been carried on along the sandy shores of Cape Cod, also formerly a noted resort of these birds; it being reported that 40,000 terns were killed there in a single season by one party for the hat-trade. At points where, a few years since, these beautiful birds filled the air with their graceful forms and snowy plumage, now only a few pairs remain.

The same sad havoc has been wrought with the egrets and herons along our southern shores, the statistics of which, could they be presented, would be of startling magnitude. We only know that colonies numbering hundreds, and even thousands, of pairs, have been simply annihilated — wholly wiped out of existence — in supplying the exhaustless demand for egret-plumes. The heronries of Florida suffered first and most severely; later the slaughter was extended to other portions of the Gulf coast. As an instance of the scale on which these operations are carried, it may be mentioned that one of our well-known ornithologists, while on an exploring tour in Texas, heard an agent of the millinery trade soliciting a sportsman to procure for him the plumes of 10,000 white egrets. Although, in the present case, the sportsman had too much humanity to become the abettor of such a heartless scheme, the incident serves to show on what a grand scale the destruction of these birds is attempted; and doubtless the agent did not fail of eventually securing his coveted plunder.

Among the birds most in favor for hat decoration are the various species of grebes, whose soft, furry plumage is particularly adapted to the purpose, being of durable texture, pleasing in effect, and susceptible of being readily dyed any desired tint. Grebes are used to such an extent, that the source of the abundant supply was not at first evident, owing to the comparative scarcity of the birds in the Atlantic states. It is found, however, that the supply is derived from the far west, mainly from

the Pacific slope, where these birds are more abundant, and whence their skins are brought east in bales, like the peltries of the furrier, or the 'robes' of the bison. The number must range far into the tens, if not hundreds, of thousands annually.

Among the smaller birds it is naturally the brighter colored species that furnish most of the victims, especially the orioles, tanagers, grosbeaks, cedar wax-wings, bluebirds, meadow-larks, and golden-winged woodpeckers. No even approximate estimate can be given of the number sacrificed. Only their conspicuous abundance on hats and bonnets, and their greatly decreased numbers, attest the slaughter to which they are subjected. But scarcely a bird can be named — from the rarest to the commonest, from the plainest of the sparrows to the most gorgeously arrayed denizens of the orchard and forest, from the tiniest warblers and humming-birds to jays, kingfishers, cuckoos, and the larger woodpeckers, and even ptarmigans and grouse (in fragments or entire), and the largest of the shore-birds, with bills half a foot in length (an *outré* and grotesque effect seeming to be sometimes especially sought) — that is not to be met with as an appendage of the female head-dress.

The assemblage of diverse and incongruous forms sometimes met with on the same hat is often striking in the extreme; birds from the opposite ends of the earth, and of the ornithological scale of classification, being brought into most inharmonious combination, viewed even from the artistic stand-point. Bearing on this subject, and illustrating the range of taste in such matters, as well as the extent to which birds are used for hat embellishment, may be given the following inventory, furnished by an ornithological friend, of what recently met his eye in a Madison Avenue horse-car in this city. The car contained thirteen women, of whom eleven wore birds, as follows: (1) heads and wings of three European starlings; (2) an entire bird (species unknown), of foreign origin; (3) seven warblers, representing four species; (4) a large tern; (5) the heads and wings of three shore-larks; (6) the wings of seven shore-larks, and grass-finches; (7) one-half of a gallinule; (8) a small tern; (9) a turtle-dove; (10) a vireo and a yellow-breasted chat; (11) ostrich-plumes. That this exhibition was by no means exceptional as to number or variety is obvious to any one who has given close attention to the ornithological displays one daily meets with in street-cars and elsewhere, wherever he may travel.

Advertisements in newspapers, by milliners, of the stock in hand, also give some suggestions of the extent of the traffic in wings and bird-skins; it being not uncommon to see thousands of wings (plain or fancy, in natural colors or dyed), as well as thousands of bird-skins (mounted or made up) and thousands of plumes (dyed or plain), advertised by a single dealer, while the dealers themselves number hundreds, if not thousands, in each of our larger cities. Add to these the smaller shops, in country and city, throughout the land, and we get at least some comprehension of the extent of the traffic in birds by the milliners, and the support they receive from the feminine portion of our population.

Respecting the traffic abroad, we learn from an English authority, that there were sold in one auction-store in London, during the four months ending April, 1885, 404,464 West Indian and Brazilian bird-skins, and 356,389 East Indian, besides thousands of Impeyan pheasants and birds-of-paradise.

DESTRUCTION OF BIRD-LIFE IN THE VICINITY OF NEW YORK.

To such an extent has the recent fashion of using birds for hat ornaments been carried, that the waters and beaches in this vicinity have been entirely depopulated of their birds. On the coast-line of Long Island the slaughter has been carried to such a degree, that where, a few years since, thousands and thousands of terns were gracefully sailing over the surf-beaten shore and the wind-rippled bays, now one is rarely to be seen.

The demand for sea-birds of white or delicate shades of color was so great, that many of the professional gunners and market-shooters gave up their usual shooting to enter upon what has proved to be a war of extermination. So long as the taxidermists who work for milliners in the large cities would take all the birds that could be supplied, the gunners were shooting day after day, from daylight until dark.

In the spring of 1884 the writer met a taxidermist from New York city, who was then on a trip along the south side of Long Island, for the purpose of making contracts with the gunners to supply him with a certain number of birds in the flesh, per day. He had facilities for making up three hundred skins daily, and was trying to arrange to get that number of birds. In answer to an inquiry as to whether he could find a market for such a number of skins in New York, he replied that he had no local trade, but that his stock was entirely for export to France.

Between Coney Island and Fire Island inlet there are many marshes, meadows, and low-lying islands, which for years have been the breeding-places of thousands of common terns or sea-swallows; and on the sandy beaches the least

tern and piping plover laid their eggs, and hatched their young. Now this long stretch of country is as a waste place, for the hand of the destroyer has left but lone remnants of what was once a teeming colony.

The small hamlet of Seaford is near the centre of this district, and has contributed largely toward the extermination of the sea-swallows. One of the most active gunners of this place informed the writer that he and his associates had, during the early summer of 1883, sent to market over three thousand terns. The slaughter of these thousands for hat ornamentation is in itself a great evil; but when we consider that the fifteen hundred pairs killed would have each produced an average of two young, or an aggregate of three thousand additional birds during the season, it becomes evident that the wrong is far-reaching.

In the vicinity of Moriches, L. I., the same character of marsh prevails, and the same destruction of seabird-life has been carried on. One of the resident gunners states that the terns are now practically exterminated, while a few years since it would have been an easy matter to shoot fifty birds during a forenoon. An observer at the eastern end of Long Island informs me that the 'summer gulls' (common terns) have greatly decreased in numbers, and the few that are left have become very wild, and difficult of approach.

The sportsman-poet, Isaac McLellan of Greenport, L.I., in a recent communication, states as follows: "There are many gunners (not sportsmen) whose whole business seems to be to kill off the little vocalists, solely for the sake of disposing of their skins and feathers for the ornamentation of ladies' bonnets. If those good women only knew of the destruction of bird-life that their love for finery occasions, I think they would make it unfashionable to wear the feathers of murdered birds. These gunners point their weapons chiefly at the gulls that haunt our shores, and I hear that they sell them by thousands to the New York dealers, at good prices. Formerly I used to see these pretty flutterers in countless flocks along the bay and seashores, but now they seem to be almost extinct. The bluefish fishermen tell me that this is a serious evil to them, as formerly, when they saw these hovering flocks, they knew that the bluefish were there, and could be easily secured. These bird-exterminators also declare bloody war against most other fine-plumaged birds, and gather in the robin, the oriole, the blackbird, the meadow-lark, catbird, and nearly all other kinds of birds."

As already intimated, the slaughter is not confined to sea-birds alone, but is waged with the same destructive force against the more beautiful of the land-birds. One gunner informed me that during the winter of 1883 he shot for a middle-man over a thousand cedar-birds (Ampelis cedrorum). If they had been permitted to live until the next season of reproduction, it is fair to assume that each pair would have reared an average of five young, or an aggregate of twenty-five hundred birds. It is a well-known fact that cedar-birds are very voracious eaters, and feed almost exclusively, during some months of the year, on the span-worm, canker-worm, and small caterpillars. The damage done the agricultural interests of the country by the destruction of these birds is enormous; but, when we multiply it by the hundreds of thousands that have been shot for the same purpose, the damage is beyond calculation.

An observer in Long Island City states, that, in his vicinity, every bird of bright plumage, such as warblers, woodpeckers, thrushes, orioles, etc., is shot for millinery purposes. In New Jersey the same wholesale destruction of bird-life was carried on, until, as I am informed by the Hon. John W. Griggs, president of the New Jersey senate, "The complaint came up from all parts of the state, of the decrease in the number of song and shore birds. Representation was made to me that certain persons had contracts to furnish birds by the thousands to taxidermists in Philadelphia and New York, and that they proposed to gather their skins in New Jersey. The bill introduced into our legislature for the protection of the birds, passed with only one negative vote, and the effect in my own locality [Paterson] has been excellent."

Another informant states, that, during the summer of 1882, taxidermists were stationed at Barnegat and Beach Haven, N.J., purchasing from the natives every thing in the nature of a sea-bird. Terns of all kinds brought ten cents each, and shore-birds the same price. Many of the baymen gave up sailing pleasure-parties, and became gunners, because this business was more remunerative: as high as fifty dollars, representing five hundred lifeless birds, being made in a week by some. "One cannot help noticing now the scarcity of terns on the New Jersey coast, and it is all owing to the merciless destruction." Besides the birds already mentioned as being immolated on the altar of fashion, thousands of crows, purple grackles (commonly known as crow blackbirds), red-winged blackbirds, and snow-buntings, are used for this purpose.

A New York taxidermist informed me that he had in his shop thirty thousand bird-skins of the species just mentioned, made up expressly for millinery purposes. Should the gunners and taxidermists bear the whole blame? I think not, as they are only supplying the demand created by

the female love of ornament. Take up any daily or fashion paper, and one can see such items as the following, clipped from the New York *Sun* of Dec. 13 and 20, 1885: "Miss Brady looked extremely well in white, with a whole nest of sparkling, scintillating birds in her hair, which it would have puzzled an ornithologist to classify," and "Mrs. Stanton Whitney had her gown of unrelieved black looped up with blackbirds; and a winged creature, so dusky that it could have been intended for nothing but a crow, reposed among the curls and braids of her hair." It is said, 'Where ignorance is bliss,' tis folly to be wise.' Perhaps, if the lady in question could have seen the crow during its lifetime perched upon and feeding on the decaying carcass of a horse, she might have objected to the association.

On the other hand we quote from the London *Truth* an item showing the humanity of England's queen: "I am glad to hear that the queen contemplates issuing a ukase censuring the barbarous fashion which so many women have lately adopted, of wearing the bodies of birds, or parts of their bodies, in bonnets and hats and on dresses. Her majesty strongly disapproves of this practice, which of late has greatly increased, which is daily increasing, and which most assuredly ought to be abolished."

As long as the ladies continue to demand bird-skins for ornamental purposes, so long will the gunners and taxidermists undertake to supply the market, therefore the initiative in the movement for the protection of birds must be with the 'wives, sweethearts, and mothers,' and not alone with the laws and lawmakers.

William Dutcher.

DESTRUCTION OF THE EGGS OF BIRDS FOR FOOD.

Few persons living at a distance from the seashore have any idea of the immense destruction of bird-life by residents of the coast, who make the systematic and wholesale robbery of water-birds of their eggs a yearly pastime. A thoughtless and relentless warfare has been waged, until extermination of all bird-life on our shores stares us in the face. This destruction has been carried to such an extent, that many of our water-birds, such as gulls, terns, herons, and shore-birds, have become scarce where formerly numberless thousands added life and beauty to our harbors and beaches. The shooting of these beautiful and graceful ornaments of our water-ways for millinery purposes is undeniably one cause of their decrease; but, great as is this cause, it is in no degree comparable to the destruction made by the so-called 'eggers,' in their annual forays in the name of food-hunting.

My scientific explorations during the last ten years have taken me to many of the breeding-places of various species of water-birds; and some facts which have come under my observation, illustrating how the few birds still to be found along our extensive coast-lines are gradually succumbing to the slaughter, may prove of interest. There is probably not a port, pass, or bay on the entire coast of Texas, whose inhabitants do not regularly devote several days each year to what they term 'egging.' As soon as the 'scouts' or fishermen report the birds established, and laying their eggs on the islands and secluded beaches, all work is suspended, every craft is pressed into service, and everybody is off to assist in the ghastly sport at the breeding-grounds. Arrived at the desired locality, the first day's work is that of thoroughly destroying every egg already laid; and this ruthless sacrifice of thousands of eggs is made before any are secured by the robbers, that they may avoid carrying away any partially incubated ones. Returning to their boats after this work of destruction, the perpetrators remain in hiding, or quietly sail about the lagoons, until the next day, by which time the distracted birds that had not laid their full complement of eggs when frightened away by the intruders, and who had meantime been hard pressed to deposit their treasures, will have laid many thousands of eggs in the very face of destruction. Two or three days are now devoted to gathering the freshly-laid eggs, and to stowing them away in barrels and tubs in the boats. All eggs, from an inch in diameter upwards, are taken, excepting, perhaps, those of the pelican, whose eggs are too fishy for any stomach. I have known of boats which came a distance of over a hundred miles to gather these eggs, cruising from reef to reef until they had secured a good load. For days after the return from these expeditions, the shops along the coast expose quantities of bird's eggs for sale, which are disposed of cheaply, according to size. As these eggs of wild birds are much more fragile than those of domestic fowls, a very large proportion of them are broken by the rough handling they receive before they reach the markets. No doubt more eggs are thus wasted than are eaten; and, unless one is familiar with the breeding-places of these birds, no idea can be formed of the appalling extent of this yearly destruction. I examined, before the eggers had reached it, one of a group of grassy islands or flats, about the size of a city block, on which were breeding not less than ten thousand birds, consisting chiefly of gulls, terns, and herons:

and, as each pair lays three or four eggs, here were at least fifteen or twenty thousand eggs on one small island. Now, when one remembers that there are hundreds and probably thousands of such resorts, where the birds are annually robbed, what must be the havoc, the cruelty, and the unwarrantable sacrifice of these harmless birds! Is it any wonder that the birds are shy, and hate the very sight of man? Is it not about time that the bird's side of the question was not only defended, but strenuously championed? The effect of this heartless and cold-blooded trampling upon the domestic instincts of birds is not calculated to encourage amicable and social relations between them and man, but quite the contrary, as the following observation will show.

I have seen laughing gulls, and royal and Caspian terns, upon being driven from their nests, deliberately dash at, and destroy with their bills, every egg exposed in the vicinity of their nests, not excepting those of their own species. Their very nature seems changed by this heartless persecution; or, recognizing the purpose of man's invasion, they intelligently and deliberately attempt to thwart his purposes by destroying the prize he covets. Such is the influence man exerts over these intelligent and persecuted birds, instead of making friendly advances to them, and by kindness encouraging in them their naturally docile and amiable propensities. How strongly in contrast is this with the pleasant sight at Geneva, Switzerland, where happy crowds of visitors delight in giving crumbs to the friendly gulls that flock about the bridges, feeding almost from the very hands of the people! There is no reason why the gulls, terns, herons, and other water-birds should not constitute one of the chief attractions at our seaside resorts, enlivening them with their grace and beauty.

In regard to the profits of the 'egging business,' I doubt if even the most successful 'egger' can make as much money as he would have done had he stuck to his regular and much more praiseworthy occupation. The quality of wild bird's eggs is inferior to that of the eggs of the domestic fowl, and consequently their price is low, and frequently barrels of them are thrown away as unsalable. This destruction, therefore, has no excuse in necessity as a source of food-supply.

If a tithe of the truth were known throughout the country at large, concerning the sacrifice of bird-life in the names of 'business,' 'enterprise,' 'food,' 'sport,' and what not, from Maine to Mexico, and from California to Alaska, there would be such a cry of remonstrance as would make the bird-destroyers hang their heads for shame.

Another fact not generally known beyond the scene of its occurrence, relating, however, to the destruction of young birds, rather than to eggs, may be here stated, which for devilish 'enterprise' exceeds any thing that has ever come under my notice. In 1877, and also in 1878, while studying the birds about Corpus Christi Bay, Texas, I examined a low grass-flat called Pelican Island, so named on account of the numbers of brown pelicans that had for years taken it for their breeding-place, to the exclusion of all other species. Here many thousands of these great birds were tending their eggs and young, breeding in such numbers that one could step or jump from nest to nest, over nearly, if not quite, every square yard of the island. Four years later I cruised over the same course, and noticed that the pelicans had deserted this grassy island entirely, and were scattered, in diminished numbers, on other islands which were not occupied by them when I made my former trips. On inquiring into the cause of this change, I learned from prominent citizens, that two or three enterprising (?) men had conceived the idea of making their fortunes from pelican-oil, and had erected 'trying-out' shanties on the mainland. They went to the island in question in large boats, and carried off cargoes of young pelicans in all stages of growth, and boiled them up for their oil. The only satisfaction I could get from the history of this experiment was, that the men could not sell the oil, and had nothing but their nefarious labor for their pains. Think of the enormous sacrifice of life for a foolish experiment! This heartless slaughter is hardly equalled in cruelty by the so-called sport of the union troops during the war against secession, who, while idly lying in transports off the passes along the coast, amused themselves by fastening a fish to a plank which was so weighted as to be quite submerged: they would then watch the pelicans dive for the fish, while bets were freely interchanged as to the probability of the bird getting a broken neck, with the odds decidedly in favor of the death of the pelican. Instances without number might be given to show that man, unchecked by law, will ruthlessly destroy the very things most useful to him if preserved and protected.

The question may be asked, What are pelicans, cormorants, gulls, terns, and herons good for? It may be answered, If for nothing else, they are good to look at and to give life and beauty to the shores and bays. They most assuredly do no harm: on the contrary, they are the scavengers of the shoal waters of our shores, as the buzzards are of the land; and if it were not that the water-birds keep in check the superabundance of almost valueless fishes and other animals that multiply in

prodigious numbers in the shallow waters, especially in warm climates, such a stench would arise from the excess which would necessarily be washed up on the shores, that all human existence about the bays would be out of the question. Nature admirably provides a check to an over-supply, as well as a protection to those weak in numbers, and, if mankind interferes too much with the harmony, retribution will surely follow. Many of our birds are fast going the way of the bison, never to return. If men were not held in check by public opinion and the necessary laws, our land would soon be as barren of all animal life as are the plains of bisons. In our greed, destructiveness, and lack of thought for our future comfort and happiness, we are not so very far in advance of the South-Sea islander, who plants his cocoanut, and has not the patience to let it grow, and yield a thousand-fold, but soon digs it up and eats it, fearing lest he lose it altogether, and then wonders why other islands are more favored than his own. GEO. B. SENNETT.

THE RELATION OF BIRDS TO AGRICULTURE.

THE utility of the so-called insectivorous birds — by which are commonly meant species which feed almost exclusively upon insects, like wood-peckers, fly-catchers, swallows, vireos, warblers, and, in less degree, the thrushes — has never been seriously questioned. The extent, however, to which other species subsist upon an insect-diet is not generally known or even suspected. Recent investigations respecting the food-habits of many of our birds show some surprising results, highly favorable to the species investigated. It has been found, for example, that all birds are to a large degree insectivorous, including hawks and owls, and even plovers and sandpipers. Professor Aughey, in his report on the food of the birds of Nebraska, published in one of the reports of the U. S. entomological commission, calls special attention to the importance of not only these birds, but the different species of the grouse family, as a check upon the grasshopper-scourge.

The great importance of the smaller birds in general, including the song-birds, as a check upon the undue increase of insect-life, and consequently the desirability of their strenuous protection, being well-nigh universally conceded, attention will be briefly called to certain species hitherto more or less generally under ban as injurious to agriculture, and whose destruction is considered praiseworthy. Foremost in this category are hawks, owls, crows, and jays. The robin, the brown-thrasher, the catbird, the chewink, and the various kinds of blackbirds, are also excluded from protection under the bird-laws of most of the states. Crows are accused, with some justice, of depredations upon the young corn, and of now and then robbing a stray hen's nest, or of gobbling up a young chicken. These last enumerated misdemeanors are exceptional, too rare even to require formal notice. The depredations upon the young corn are easily guarded against, as a small quantity of grain thrown upon the ground is greatly preferred by the crows to the few kernels they can acquire by pulling that which has been planted. Many farmers, indeed, consider it much more to their interest to feed the crows for a few days than to destroy them, recognizing the fact that at all other times they are among their best allies; their food consisting largely of grasshoppers, cut-worms, and other noxious insects. Why the jays have been tabooed is hard to explain, their pilferings being at most of a trivial character, while, as destroyers of noxious insects, no birds, it may be safely said, are more important. The other species named above (aside from the hawks and owls) are well known to levy tribute on the small fruits of the garden, the robin particularly, to a somewhat serious extent; while the catbird, brown-thrasher, and chewink not unfrequently pull the corn planted near the thickets they inhabit. Otherwise these species are among the most useful of our birds, whose services are to such an extent recognized, that opinion is divided — even among those who suffer most from their depredations — on the subject of whether or not they are, during the short period of the fruit-season, to be treated as outlaws. In certain portions of the country, particularly in the south, the depredations of the blackbirds upon the grain and rice-fields are of serious character; but throughout at least three-fourths of the states there is certainly no good reason for destroying these otherwise useful birds.

Hawks and owls, from time immemorial, have been treated as foes, and legitimate targets for the rifle or shot-gun on all occasions; their destruction having been not unfrequently encouraged by the offer of bounties from the public treasury for their heads. Of late, frequent protests have been raised against this indiscriminate slaughter. These protests come mainly from ornithologists who have studied their food-habits, and become convinced that their destruction is not only unnecessary, but unwise. A number of published protests might be here cited, did space permit, based on actual knowledge of the facts in the case, and giving statistics of the contents of stomachs of many examples of different species of birds of prey. Only a few of the statistics at hand can

be here presented. Mr. B. H. Warren, a well-known ornithologist, in a paper entitled 'What hawks eat,' published in a recent report of the Pennsylvania board of agriculture, states, respecting the red-tailed hawk (Buteo borealis), — the 'hen-hawk' *par excellence* of eastern North America, — that an examination of the stomachs of one hundred and one examples of this species "revealed in eighty-one chiefly mice and small quadrupeds, also some small birds; nine, chickens; three, quail; two, rabbits; one, a part of a skunk; one, a red squirrel; one, a gray squirrel; three, snakes." In the stomachs of thirty-four red-shouldered hawks (B. lineatus) examined were found, in twenty-three, mice, small quadrupeds, grasshoppers, and coleopterous insects; in nine, frogs and insects; in the remaining two, small birds, hair, and orthopterous insects. Of twelve broad-winged hawks (B. latissimus), four contained mice; three, small birds; four, frogs; one, crayfish and insects. The contents of the stomachs of twenty-nine sparrow-hawks (Falco sparverius) was, in fifteen cases, principally mice with traces of various insects; in six, grasshoppers; in two, coleoptera and grasshoppers; two, meadow-larks; four, sparrows. Nine rough-legged hawks (Archibuteo lagopus sancti-johannis) examined had all fed exclusively upon field-mice. Of eleven marsh-hawks (Circus hudsonius), the stomachs of five contained mice; of two, small birds; of three, frogs; the other, grasshoppers and rabbit's hair.

The hawks of the genus Accipiter, on the other hand, present a bad record; fourteen out of twenty-four Cooper's hawks (A. Cooperi) being found to contain chickens, seven others, birds, and three, only mice and insects. Of sharp-shinned hawks (A. velox), four out of fifteen contained chickens; nine, small birds; one, mice; and one, insects. On the other hand, it is known that several other species of the hawk family feed almost exclusively upon insects, mice, snakes, and frogs.

Careful examination of the contents of stomachs of owls, of which the results have been published, show that field-mice constitute their principal food, and that grasshoppers and other insects enter largely into the diet of all the smaller species. The larger species add to their usual fare of mice and the smaller mammals, many grouse and rabbits.

In short, enough is known of the regimen of our rapacious birds to show that they are only exceptionally harmful to the farmer; their infrequent raids — mostly by a few species — on the poultry being much more than offset by their destruction of mice, grasshoppers, and other injurious insects.

In this connection, reference may be appropriately made to the letters from farmers and fruit-growers, as well as bird-lovers, from various parts of the country, addressed to the committee of the American ornithologists' union on bird-protection, detailing the vast injury they recognize as resulting to agriculture from the present wholesale slaughter of birds. An extract from a letter from a farmer in Dexter, Mich., will indicate the general purport of these communications. "The destruction of birds has been and is carried on here to such an extent that it is hardly possible to raise any kind of fruit; even the grapes, as well as the apples, being too wormy for use or sale. Boys, and even sires of families, but not men, go out and shoot swallows, robins, larks, etc. It makes no difference if they are nesting; and many a nest of young birds have starved on account of their parents being shot. And the small boy with his sling-shot destroys many — and all for the desire to murder. . . . There is a law to prohibit all this; but those who could enforce it take no interest in the matter. Not a single person saves the skins for gain: the birds are thrown away, or left where they fall. I have protested against the cruelty, but to no purpose, except in a few instances. The game and bird laws should be enforced by men appointed for the purpose, who should receive a salary, so that they may make it a business."

BIRD-LAWS.

MOST of the states and territories have on their statute-books laws for the protection of game and fish, regulating the season of hunting and fishing, and providing penalties for the taking of game or fish during certain portions of each year, or, in particular cases, for a series of years. These laws are intended, in most cases, to give protection to 'useful' birds, in addition to the game-birds, and their nests and eggs, at all seasons. In general, these laws are crude and unsatisfactory so far as they relate to supposed useful birds, and also in relation to many others which are either protected merely during certain months, or not at all, as is the case with many of the marsh and shore inhabiting species, such as the herons, terns, gulls, etc. Most of the laws exclude from protection all hawks and owls, crows, jays, and blackbirds, and, in some cases, robins and other kinds of song-birds, woodpeckers, etc. A few of the laws make provision for collecting birds and their eggs for scientific purposes, often in a lax way, but occasionally, as in Maine, with considerable stringency; while the new bird-law of New Jersey prohibits the destruction of song-birds, their nests or eggs, for any purpose whatever. Defective as

the present laws now generally are, they would, if thoroughly enforced, prevent the disgraceful slaughter now so general, and untrammelled by any legal interference. As already so many times reiterated in this series of papers, the fault is not so much lack of laws, or inadequate legislation, as the absence of nearly all effort to interpose any obstacles, legal or otherwise, in the way of free slaughter. So apathetic is the public in all that relates to bird-protection, that prosecution under the bird-protection statutes requires, on the part of the prosecutor, a considerable amount of moral courage to face the frown of public opinion, the malignment of motive, and the enmities such prosecution is sure to engender.

None of the bird-laws are above improvement, even in so far as they relate to the protection of game-birds; but, in respect to the non-game birds, nearly all require more or less change. If possible, it would be well to have uniform laws throughout all the states and territories, varying only in respect to the time of the close season, and such other points as difference of season, kind of game to be especially protected, etc., according to local conditions. At present, certain birds are protected in some states which are outlawed in others, or are treated as game-birds in some, and not so treated in others.

Birds, as regards legislation, may well be divided into two classes, — game-birds, and birds which are not such; and the laws relating to each class should be separate and distinct. The game-birds should be left to the care of sportsmen and game-protective associations, since self-interest on the part of the more intelligent sportsmen will dictate more or less wise legislation for the preservation of the birds on which their sport depends. But in respect to game-birds, public opinion should be so far enlightened as to secure the enforcement of proper legislative enactments; which is notoriously not the case at present. All other birds should be left to the care of bird-lovers and humanitarians, who should see that proper laws for their preservation are not only enacted, but duly enforced. As already shown in preceding pages of this *Supplement*, those who know best, from having scientifically investigated the subject, are convinced that none of our native birds should be outlawed as unqualifiedly, or even to any serious degree, injurious. A few exceptions might be made, were it practicable; but, in the general ignorance of legislators and of the public generally, — or their inability to make proper distinction through inability to recognize by proper names one kind of hawk, for instance, from another, — the safe way is to attempt no such discrimination in legislation. The slight harm resulting from protecting half a dozen species more or less harmful would be more than offset by the indiscriminate destruction which would necessarily result from such a loophole.

The reason for keeping legislation respecting game-birds distinct from that relating to the other species is mainly to avoid conflict of interests respecting such legislation, which is more or less sure to follow in any attempt at combined legislation respecting all birds in one act. Sportsmen's clubs and game-protective associations in attempting to provide proper game-laws often find strong opponents in the game-dealers and market-gunners, who often succeed in defeating judicious legislation. If all birds are treated under the same act, attempts to improve the portions of such acts as relate to useful birds are often prevented through opposition to certain clauses of the game-sections obnoxious to pot-hunters and game-dealers, as has recently been the case with attempted judicious amendments to the bird-laws in the state of Massachusetts.

There should also be some provision for collecting birds, their nests and eggs, for scientific purposes, in behalf of our natural history museums and of scientific progress in ornithology. As already shown in these articles, the birds destroyed in the interest of science, notwithstanding the outcry to the contrary from certain sources, are relatively few in comparison to the number destroyed for millinery and other mercenary purposes, — so small as not to materially affect the decrease of any species. But such license, unless rigidly guarded, is liable to abuse, and should be hedged about with every practicable safeguard. The number of such licenses issued in any state should be very small; they should be granted with strictest regard to the fitness of the recipient to be allowed such a favor; and their abuse or misuse made a misdemeanor subject to severe penalties. Obviously, the power to grant them should, so far as possible, be vested in persons having some knowledge of ornithology, or who are able to recognize the difference between collecting birds for scientific purposes and as 'curiosities,' or for traffic other than strictly in the interest of science. It should be further understood that these licenses grant no immunity from the ordinary laws of trespass, or laws against the use of fire-arms at improper times or places, or in violation of any of the provisions of game-protective acts. The system of issuing such licenses has needlessly been brought into disrepute through the gross ignorance and apathy of the general public as to their real purpose and limitations. For most of the abuses of the system there is already abundant remedy. Any person holding

such a license, who uses it as a shield against prosecution for illegal or indiscriminate slaughter of birds for any and all purposes, is successful only to such extent as the ignorance or apathy of the community among which his misdeeds are committed happen to give him immunity. The fault is not in reality chargeable to the law, or the system permitting the granting of certificates for scientific collecting. In this matter, as in all else relating to bird-destruction, all that is necessary to prevent abuses is a proper comprehension of the laws relating to the subject, and a public sentiment not only favorable to their enforcement, but watchful against any infringement of their provisions.

With a desire to bring about more intelligent, uniform, and desirable legislation for the protection everywhere, and at all times, of all birds not properly to be regarded as game-birds, the American ornithologists' union committee on bird-protection have had under careful consideration a draught of a bird-law drawn with special reference to its fitness for general adoption throughout the United States and the British Provinces, and with regard to just what birds should be so protected. It is intended as a guide or model, which may serve as a basis for legislation. From its pertinence in the present connection, it is given below in full. Possibly some additional provisions may still be desirable, relating especially to the designation of certain officers to secure its strict observance, the amount of the fine, and whether or not a part of the fine should go to the complainant,—features, however, that doubtless may be safely left to legislative discretion.

[AN ACT FOR THE PROTECTION OF BIRDS AND THEIR NESTS AND EGGS.]

SECTION 1.—Any person who shall, within the state of ——, kill any wild bird other than a game-bird, or purchase, offer, or expose for sale any such wild bird, after it has been killed, shall for each offence be subject to a fine of five dollars, or imprisonment for ten days, or both, at the discretion of the court. For the purposes of this act the following only shall be considered game-birds. The Anatidae, commonly known as swans, geese, brant, and river and sea ducks; the Rallidae, commonly known as rails, coots, mud-hens, and gallinules; the Limicolae, commonly known as shore-birds, plovers, surf-birds, snipe, woodcock, sandpipers, tatlers, and curlews; the Gallinae, commonly known as wild turkeys, grouse, prairie-chickens, pheasants, partridges, and quails.

SECT. 2.—Any person who shall, within the state of ——, take or needlessly destroy the nest or the eggs of any wild bird, shall be subject for each offence to a fine of five dollars, or imprisonment for ten days, or both, at the discretion of the court.

SECT. 3.—Sections 1 and 2 of this act shall not apply to any person holding a certificate giving the right to take birds, and their nests and eggs, for scientific purposes, as provided for in section 4 of this act.

SECT. 4.—Certificates may be granted by [here follow the names of the persons, if any, duly authorized by this act to grant such certificates], or by any incorporated society of natural history in the state, through such persons or officers as said society may designate, to any properly accredited person of the age of eighteen years or upward, permitting the holder thereof to collect birds, their nests or eggs, for strictly scientific purposes only. In order to obtain such certificate, the applicant for the same must present to the person or persons having the power to grant said certificate, written testimonials from two well-known scientific men, certifying to the good character and fitness of said applicant to be intrusted with such privilege; must pay to said persons or officers one dollar to defray the necessary expenses attending the granting of such certificates; and must file with said persons or officers a properly executed bond, in the sum of two hundred dollars, signed by two responsible citizens of the state as sureties. This bond shall be forfeited to the state, and the certificate become void, upon proof that the holder of such a certificate has killed any bird, or taken the nest or eggs of any bird, for other than the purposes named in sections 3 and 4 of this act, and shall be further subject for each such offence to the penalties provided therefor in sections 1 and 2 of this act.

SECT. 5.—The certificates authorized by this act shall be in force for one year only from the date of their issue, and shall not be transferable.

SECT. 6.—The English or European house-sparrow (Passer domesticus) is not included among the birds protected by this act.

SECT. 7.—All acts, or parts of acts, heretofore passed, inconsistent with or contrary to the provisions of this act, are hereby repealed.

SECT. 8.—This act shall take effect upon its passage.

AN APPEAL TO THE WOMEN OF THE COUNTRY IN BEHALF OF THE BIRDS.

THE relation of the women of the country to the present lamentable destruction of bird-life has been several times alluded to in the foregoing pages; but the matter is so important, it demands more formal notice in the present connection. The destruction of millions of birds annually results from the present fashion of wearing birds on hats and bonnets. The women who wear them, and give countenance to the fashion, have doubtless done so thoughtlessly, as regards the serious destruction of bird-life thereby entailed, and without any appreciation of its extent or its results, considered from a practical stand-point. Until recently, very rarely has attention been called to the matter, or the facts in the case been adequately set forth. They have therefore sinned, for the most part, unwittingly, and are thus not seriously chargeable with blame. But the case is now different, and ignorance can no longer be urged in palliation of a barbarous fashion. Obviously it is only necessary to call the attention of intelligent women to the subject, as now presented, to enlist their sympathies and their efforts in suppression of the milliner's traffic in bird-skins. As a recent writer (Mr. E. P. Bicknell, secretary of the A. O. U. committee on bird-protection) in the *Evening post* of this city has not only forcibly appealed to the women in behalf of the birds, but suggested to them certain desirable lines of action, this brief reference to the subject

may well be concluded with a few pertinent extracts from the article in question.

"So long as demand continues, the supply will come. Law of itself can be of little, perhaps of no ultimate, avail. It may give check; but this tide of destruction it is powerless to stay. The demand will be met; the offenders will find it worth while to dare the law. One thing only will stop this cruelty, — the disapprobation of fashion. It is our women who hold this great power. Let our women say the word, and hundreds of thousands of bird-lives every year will be preserved. And, until woman does use her influence, it is vain to hope that this nameless sacrifice will cease until it has worked out its own end, and the birds are gone. . . . It is earnestly hoped that the ladies of this city can be led to see this matter in its true light, and to take some pronounced stand in behalf of the birds, and against the prevailing fashions.

"It is known that even now birds are not worn by some, on grounds of humanity. Yet little is to be expected from individuals challenging the fashion: concert of action is needed. The sentiment of humanity once widely aroused, the birds are safe. Surely those who unthinkingly have been the sustaining cause of a great cruelty will not refuse their influence in abating it, now that they are awakened to the truth. Already word comes from London, that women are taking up the work there. Can we do less? It needs only united action, sustained by resolution and sincerity of purpose, to crush a painful wrong, — truly a barbarism, — and to achieve a humane work so far-reaching in its effects as to outsweep the span of our own generation, and promise a blessing to those who will come after."

There are already in England, it may be added, two societies organized expressly in aid of the preservation of birds 'in Great Britain and all other parts of the world.' The Selborne society, originated by George Arthur Musgrave of London, appeals to Englishwomen "to forswear the present fashion of wearing foreign or English bird-skins. Our countrywomen are asked to inaugurate a return to a mode which, though half forgotten now, is assuredly more becoming to the wearer than trophies of robins and sandpipers." Lady Mount Temple is not only a member of the plumage section of the Selborne society, but has written a vigorous protest against the fashion of wearing dead birds on dresses, bonnets, and hats. The section is under the patronage of her Royal Highness the Princess Christian of Schleswig-Holstein, and numbers among its membership twenty ladies of title, and also Lord Tennyson, Robert Browning, Sir Frederick Leighton, and Rev. F. O. Morris.

THE AMERICAN ORNITHOLOGISTS' UNION COMMITTEE ON BIRD-PROTECTION.

THE American ornithologists' union committee was recently organized in New York city with the following membership: Mr. George B. Sennett, chairman; Mr. Eugene P. Bicknell, secretary; Mr. William Dutcher, treasurer; Mr. J. A. Allen, Dr. J. B. Holder, Dr. George Bird Grinnell, and Mr. L. S. Foster, all of New York city; Mr. William Brewster, Cambridge, Mass.; Mr. Montague Chamberlain, St. John, N.B.; Col. N. S. Goss, Topeka, Kan.

The committee is desirous of collecting facts and statistics bearing upon the subject of the destruction of our birds, and will welcome information from any source. It also extends the promise of its hearty co-operation to all persons or societies who may be interested in the protection of birds.

The headquarters of the committee are at the American museum of natural history, Central Park, New York city, where the officers or any of the members may be addressed.

THE Third report of the Cornell university experiment-station, 1883–84 and 1884–85 (Ithaca, N. Y., *Andrus & Church*, 1885, 39 p., 8°), contains an account of work done in the years 1882–85 chiefly by Professors Roberts and Caldwell. Although the experiments are comparatively simple, and show plainly that they were made in the intervals of other duties, they still show a degree of insight and accuracy in plan and execution, and are reported with a clearness of statement which we sometimes look for in vain in more pretentious reports. We may mention particularly Professor Roberts's determinations of the value of stable-manure, and Professor Caldwell's comparisons of the chemical composition and nutritive effect of certain rations for cattle. The subject of the first-named experiment is one which has usually been treated deductively, and hence these experiments are of interest not only in their direct application to farm practice, but because they serve to a certain extent to justify the deductions of science. The feeding-experiments show the uncertainty attaching to the use of the so-called 'feeding-standards' or 'standard rations' which have been somewhat widely recommended by writers on agricultural science. Evidence seems to be accumulating that these standards, in their present form, are very uncertain guides, and that, even if not based on false premises, they require great modifications before they can be made of much use to those most needing the information.

SCIENCE.

FRIDAY, MARCH 5, 1886.

COMMENT AND CRITICISM.

IT SEEMS PROBABLE that in the latter part of April, and first part of May, we are to have the unusual spectacle of two fine comets visible at the same time. We have already mentioned the increasing brightness of Barnard's comet, and we now learn, from Dr. Oppenheim's study of the comet discovered by Fabry at the Paris observatory on Dec. 1, that this comet will greatly surpass Barnard's in brilliancy. It will be seen in the north, and its position will be very similar to that of the brilliant comet of 1881. For a short time it will not set at all in our latitude, but will remain visible throughout the night. The comet is now visible in a moderate-sized telescope, and is increasing slowly in brightness. About April 1 the increase will become more rapid, and by the middle or latter part of that month it will undoubtedly become visible to the naked eye. Its maximum brightness, over six hundred times as bright as when it was discovered, will be reached about the first of May, when it will be situated in the sky, not far from Barnard's comet; and by the end of May it will have passed south of the equator, becoming again a telescopic object. Another favorable circumstance is noted in the fact, that, when the comet is at its brightest, there will be no moon to detract from its splendor. Dr. Weiss points out the possibility that on the 26th or 27th of April the comet may be between us and the sun, and may consequently be projected on the sun's disk.

THE ANNUAL REPORT of the managers and superintendent of the reformatory at Elmira to the New York legislature is not a very large document, but every page of it is of the greatest interest. It is the record of the progress of an attempt, not merely to confine and punish criminals, but to reform them, and to make good and useful citizens out of a class of men usually given over altogether by society as dangerous. It will be remembered that this institution was founded in 1870; and it was then enacted, that, at the discretion of the court, any male criminal between the ages of sixteen and thirty, who had not previously been sentenced to a state prison in this or any other country, might be sent to it; and by the provisions of the act the managers were made a reforming and not a merely punishing body. No criminal was to be confined for a longer period than the legal term of the sentence for the crime of which he was convicted; but he might be released at any time after six months' confinement, if, in the judgment of the managers of the institution, he was sufficiently reformed to be trusted with his freedom. How well Mr. Z. R. Brockway, the superintendent, has succeeded in his task of reformation, is well known to students of our penal institutions, and the many problems connected with them. But we believe that the general public will hardly be prepared to hear the facts and figures adduced in the present report.

Mr. Brockway believes that the common incentives to crime are ignorance, improvidence, and indigence; and he undertakes to employ the time during which the prisoners are confined, in endeavoring to remove and guard against these incentives. To ignorance he opposes education; to improvidence and indigence, voluntary earning and saving; and he calls these "indispensable elements in any rational, effective, reformative system of prison management." The details of the scheme of instruction, as given in this report, are marvellous, especially those concerning the English literature class, which is a new feature, and one called into being in order to fill in the gap between the hours of compulsory labor and compulsory study, — a period "in which inmates returning to their accustomed thoughts often return, at the same time, to their former selves; so that much labor was lost, and injury derived." Imagine five hundred felons intently poring over 'Hamlet,' the 'Canterbury tales,' 'Rasselas,' Bacon's 'Essays,' Browning's 'Rabbi ben Ezra,' — names selected at random from a long list of works studied! This sounds very fanciful; but, as a matter of fact, the results are very practical. The reformatory keeps accurate statistics regarding its inmates; and, of the 2,061 prisoners handled under the act of 1877, the state has protection against 1,878, or 91.1 per cent; and it is

unprotected against only 183, or 8.9 per cent. Of the former number, 658 are still in custody at the reformatory, 109 were released and sent out of the state, 11 were absolutely released as satisfactory without any parole, and 735 were released after parole.

Mr. Brockway, in another set of tables, estimates that 81.2 per cent of the whole number paroled are reformed, and that only 16.3 per cent returned to criminal practices or contact. This is a wonderful showing, and betokens a departure in prison theory and practice that should before long become general. Under this system the state does not lock its offenders up for a certain time, and then take its chances with them; but it employs the months of confinement in guarding itself against the future. On the consequent advantages to the criminal and to society, not a word need be wasted. An interesting and valuable appendix to the present report is a series of charts, prepared by Mr. Brockway, to show graphically the fluctuations in the course and progress toward release, of one thousand prisoners under the reformatory system. They show some curious cases of what may be called 'reversals to type,' and are valuable as psychological and ethical studies. The average population of the institution in 1885 was 647; the average period of detention of the present inmates was 16.9 months; and the average detention before parole, and of the whole number paroled to date, was 20.7 months.

THE COMMITTEE of the national academy, to which was referred the question of a new naval observatory, as mentioned in our last week's issue, was called upon by the secretary of the navy for an opinion on two other questions of considerable interest to astronomers: viz., the expediency of making the change in the beginning of the astronomical day from midnight to noon, as recommended by the meridian conference; and as to the advisability of asking congress to make an appropriation for the observation of the total solar eclipse of Aug. 28-29. In regard to the astronomical day, the committee recommends that the change should be made as soon as sufficient concert of action can be secured among the leading astronomers and astronomical establishments of the civilized world, —'in 1890 if possible; if not, in 1900.' This conclusion is reached, in view of the general consensus of the astronomers of this country in favor of the change, and the adhesion to the same view of so important an institution as the Royal observatory of England.

In regard to the observation of the eclipse, the committee is not in favor of calling upon congress for an appropriation, on the ground, mainly, that there would not probably be sufficient time to make such preparation of instruments and observers as to insure results commensurate with the magnitude of the undertaking. The report says, "In addition to the observation of the sun itself, and the luminous phenomena attending it, it is desirable to obtain photographic maps of all the surrounding region, to the distance of at least ten or fifteen degrees from the sun, for the purpose of finally setting at rest the still mooted question of an intra-mercurial planet. It is true that the astronomical world is at present disposed generally to discredit the existence of such a body; yet the evidence on the subject, up to this time, is mainly negative, as it must always continue to be, so long as it depends upon direct vision. In a photographic map taken during total eclipse of the sun, of the whole region within which such a planet must necessarily be confined, the object, if present, must present itself, and could not fail to be recognized."

RAILWAY COMPANIES have become so important a part of our industrial organization, and the power they wield is so great, that the right adjustment of their relations to individuals and to the public at large is imperatively necessary. Troubles are constantly arising between the companies themselves, between the companies and shippers, and between the companies and their employees, leading oftentimes to a great disturbance of the national industry. A railroad 'war' is raging at this very moment among the trans-continental lines at the west; and it is only a short time since a dispute between corporations and their workmen almost paralyzed the business of Galveston. How such disputes can best be settled, — whether by state regulation, by arbitration, or by leaving the evil to work its own cure, — is the question before us deserving notice. We would call attention to a certain distinction which prevails in the matter, and which is liable to be insufficiently attended to. The state may interfere with the making and execution of contracts for either of two purposes, — for the sake of the contracting parties or of one of them, or

for the sake of third parties or of the general public. A contract between two parties may have an important effect on the rights and interests of persons who are noway concerned with the making of it, and in such cases it has long been the custom for the state to interfere for the protection of those persons. Such cases often arise in relation to common carriers.* For instance: if a railway company charges one shipper a higher price for carrying freight than it charges another for the very same service, it does injustice to the party against whom the discrimination is made; hence recent decisions of the federal courts have declared such discrimination to be unlawful.

THE MEETING of the American economic association, held on Saturday last in this city, indicated that the interests of the association are being wisely provided for, and that the plans under preparation are in the interest of true science. It showed itself cautious, and gave no countenance to the establishment of a newer creed with fresh dogmatic utterances. In the deliberations the prominent fact stood out that the purpose of the society must be in method. Scientific method of investigation is the great need of economics at the present time, and it is to this department of work that this new association can unfalteringly commit itself. The patient collection and analysis of facts is a necessity which requires no apology in these days of confusing arguments drawn from insufficient statistical and social data. The council, however, assembled for practical work, and took a step forward in the development of the usefulness of the society by admitting the Connecticut valley economic association into its membership. This force, of about seventy-five members, is located chiefly at Springfield, Mass., and is a local society recently founded, and modelled after the constitution of the larger association. It was also determined to publish at an early date one or two monographs, as well as the secretary's report, which will shortly be in print.

GEOGRAPHY-TEACHING IN GERMANY.

IN the matter of geographical education, Germany may be taken as the model which other European countries are following, so far as their special circumstances will permit. It is true that teachers like Dr. Lehman and Professor Wagner are not satisfied with the position yet attained in German schools. But to the eyes of Mr. Keltie, accustomed as they were to the methods and appliances of English schools, Germany seemed very far ahead. He therefore devoted a considerable portion of his 'report,' recently published by the Royal geographical society, to a description of what we may call the German system of geographical education. According to him, the ideal aimed at, and indeed being rapidly carried out, is to have one continuous course of geographical instruction from the first year in the primary school up to the university.

The preliminary stage, or what is known in Germany as *heimatskunde*, combined with or preceded by actual observation, is met with in nearly all the primary schools and in the preparatory classes of the higher schools. There are no text-books in this early stage, except for the teacher, the pupil obtaining his ideas from actual observation or practice. The instruction begins with the student's home surroundings, and proceeds outwards from the town to the district, then to the province, Germany, Europe, and, finally, the world in general. At the outset the pupils are given a mastery of the cardinal points, the course of the sun in the heavens, and similar elementary notions. This is done, not by compelling him to commit the compass-card to memory, but by getting him to find the direction of his own house from the schoolroom, and by encouraging him to apply a few simple ideas in his daily walks and games. The next step is to teach him how to read a map. Here, again, his local knowledge is utilized. A map of his own town is procured, and he learns how to trace his own homeward path, and to find out the direction of some well-known buildings. Then he often visits, map in hand, the surrounding country, and thus learns the actual meaning of this or that geographical symbol. Often these excursions are extended to distant points of interest. Many teachers think that students acquire this faculty of map-reading best by learning how to use the geographical symbols themselves, or, in other words, by practice in map-drawing; but, wherever this method is followed, it is insisted on that the drawing is done, not to produce a work of art, but solely to familiarize the pupil with contour lines, mountain-shading, and other similar signs. In some schools the pupils build up the relief of a country with sand; in others the contour lines are reproduced in card-board, and the relief is built up with great exactness. When the maps are well made, as most modern German maps are, no better way to teach the meaning of geographical symbols could be devised. But the conditions must be favorable; and, above all, maps with unusual symbols, such

as water-partings indicated by black lines, should never be used in the schoolroom.

The young German does not leave his geography behind when he leaves the primary school. Far from it, as, in the gymnasia and *realschulen*, geography is taught for two hours a week throughout the whole course, except that, in some gymnasia (classical schools), the last two years are devoted to other subjects. What is actually taught may be gathered from the following summary of the programme of the *realschule* of the first order at Leipzig: —

Sexta (lowest class). — Leading principles of physical geography, general view of the earth, geography of Saxony, exercises in map reading and drawing.

Quinta. — Advanced instruction in the above branches, Germany taking the place of Saxony as the special subject.

Quarta. — Revision of the work of the two previous years, extra-European continents.

Tertia. — Germany, both physical and political, map-drawing.

Unter secunda. — Foreign European countries and their colonies.

Ober secunda. — Extra European continents, especially as to their physical conditions.

Unter prima. — Astronomical geography.

Ober prima. — Revision of the whole field, astronomical geography.

As to methods, Mr. Keltie was impressed by the fact that the teaching of geography was a much more lively operation on the continent than in England. In Germany the teacher counts for a great deal; the text-book, for very little. There is almost no lesson-hearing; the text-book, when used, simply furnishing a text for the teacher's explanations. No attempt is made to crowd the lessons with minute details—no long lists of names; no tables of statistics, of population of cities, lengths of rivers, or heights of mountains. The memorizing is confined to the leading principles, facts, and features. In fine, when a German boy leaves the higher school for business or the university, he carries with him a sound working knowledge of geography.

Of course, there could not be such good teaching without good teachers; and it is a fact to be noted, that, at the present moment, the leading universities of Germany set out to train teachers of geography exactly as they do teachers of history, archeology, or botany. A dozen years ago this was not so, as nearly all the twelve professorships of geography have been founded since 1873. Now, however, geography is on an equal footing with other branches in more than half of the German universities. At Goettingen, for example, a man may take his doctorate, with geography as his special subject. Then, too, there are examinations for the right of teaching (*facultas docendi*) geography in the higher schools. These examinations are of two degrees or stages: 1°, for the right to teach in the lower classes; and, 2°, for the right to give instruction to the highest classes. The course for this last examination extends over two years. The candidate must attend a systematic series of lectures on the facts and principles of geography. At the *übungen*, or exercises for advanced students, practice in the best methods of teaching is afforded. Special investigations are encouraged by some professors, as, for instance, by Rein at Bonn, and Richthofen at Leipzig. Mr. Keltie 'assisted' at one of these practice-courses, and was evidently surprised at the excellence of the work presented. There is no doubt, that, as the supply of well-trained teachers becomes more ample, the teaching of geography will be still further improved. What has already been accomplished is well set forth in the following sentence from the recent 'memorial' of the Royal geographical society: —

"An impartial comparison of the literary results of English and German travel at the present day seems to show that the educational advantages which we ask for in England, and which are attainable in Germany, have there borne their actual fruit in developing and directing the powers of observation in German travellers."

METEOROLOGICAL CONFERENCE.

On invitation of the chief signal officer, U. S. army, representatives of a number of the state weather services met in Washington on Feb. 23 and 24, to consider the relation of state services to the signal service, matters of observation, display of local weather-signals, and related topics. The meeting was opened by General Hazen, chief signal officer. Prof. T. C. Mendenhall of the signal office was then chosen chairman, and Prof. W. M. Davis was appointed secretary. Four sessions were held in the lecture-room of the national museum, and the following action was taken.

The conference recommends that the volunteer observers of the state weather services should make their regular thermometric observations at 7 A.M., 2 and 9 P.M. When maximum and minimum thermometers are used, they should be read at the latest hour of observation in the day, preferably at 9 P.M. Observers of rainfall are advised to use the new form of rain-gauge adopted by the signal service, or to follow this pattern as nearly as possible. The gauge should, when practicable, be placed with the collecting-edge one foot above the ground, and should stand at least twice as far from adjacent objects, such as trees, buildings, fences, etc., as the height of these objects. The conference disapproves of placing rain-gauges on the roofs of buildings.

Committees were appointed as follows: Messrs. Dunwoody, Mell, and Upton, to prepare forms for records to be used by state services and volunteer observers; Messrs. Davis, Thomas, Mell, Dunwoody, and Woodruff, to report on a system of weather-signals for local display throughout the country; Messrs. Mendenhall, Fuertes, Dunwoody, Upton, and Payne, to consider plans for a permanent organization of the conference.

The attendance at the conference represented so many parts of the country, that its recommendations will doubtless have due weight in securing the desirable end of uniform methods of work in the state services now in operation, and in those yet to be formed. Among the members of the signal service, there were present Professor Mendenhall, Lieutenants Dunwoody, Woodruff, Finley, Walshe, and Day, Professors Ferrel, Abbe, Hazen, Russell, and Marvin, and Mr. McAdie. The state services were represented by Professor Thomas of Ohio, Professor Payne of Minnesota, Professor Young of Nevada, Professor Mell of Alabama, Messrs. Henderson and Redding of the bureau of agriculture, Georgia, Professors Upton and Davis and Messrs. Rotch and Ellsworth of New England, and Professor Huston of Indiana. Professor Fuertes of Cornell university, and Mr. Gillingham of Virginia, volunteer observers of the signal service, were also present.

The conference adjourned, to meet again at the call of the committee on permanent organization.

At the meeting of the committee on permanent organization, held after the adjournment of the conference, it was decided to organize under the name of the 'Association of local weather services,' and to hold meetings annually in February. The object of the association is to encourage and promote the mutual co-operation of the local weather services and the general weather service of the United States. Its membership is limited to the officers of local services or duly appointed delegates, together with representatives from the chief offices.

METHOD OF STATING RESULTS OF WATER-ANALYSES.

THE Chemical society of Washington, at the meeting of Nov. 12, 1885, appointed a committee to consider the present state of water-analyses, and to present a method of stating analyses adapted for general use, in order that those hereafter published may be readily compared with each other and with future work. This committee reported Feb. 11, 1886, and was authorized to prepare an abstract for publication, in order to call the attention of chemists to the subject.

The society earnestly recommends the adoption of the scheme which is herewith briefly presented. The full text of the report will be published in the next bulletin of the society.

Water-analyses are usually made to answer one of three questions: viz., 1°, Is the water useful medicinally? 2°, Is it injurious to health? and, 3°, Is it suitable for manufacturing purposes? Many books relating to water were published during the eighteenth century, but accurate chemical analysis was not attempted until about 1820. As the earlier analyses were isolated, rare, and made for special purposes, the form of the statement was of little importance, if it was only intelligible. At the present time, however, water-analyses are very numerous. An examination of about a thousand shows some forty-two methods of stating quantitative results, there being sometimes three different ratios in the report of one analysis. Such discrepancies render comparisons difficult and laborious.

The various methods of statement may be classified under the following general forms: —

1°. Grains per imperial gallon of 10 pounds, or 70,000 grains.

2°. Grains per U. S. or wine gallon of 58,372 + grains.

3°. Decimally, as parts per 100, 1,000, 100,000, or 1,000,000.

4°. As so many grams or milligrams per litre.

The last two would be identical if all waters had the same density; but as the densities of sea-water, mineral waters, etc., are much above that of pure water, it is plain that the third and fourth modes are not comparable.

The committee therefore unanimously recommends —

1°. That water-analyses be uniformly reported, according to the decimal system, in parts per million, or milligrams per kilogram, with the temperature stated, and that Clark's scale of degrees of hardness, and all other systems, be abandoned.

2°. That all analyses be stated in terms of the radicals found.

3°. That the constituent radicals be arranged in the order of the usual electro-chemical series, the positive radicals first.

4°. That the combination deemed most probable by the chemist should be stated in symbols as well as by name.

The abandonment of Clark's scale has been recommended by Wanklyn and Chapman; and the recommendation made by the committee does not involve the disuse of his method, but merely the bringing of it into accord with the decimal system, — the changing from grains per gallon to milligrams per kilogram.

The last conclusion (No. 4) was deemed desirable from the frequent confusion in the statement of the iron salts and of the carbon oxides.

The committee is unanimously of the opinion that analyses in the form recommended will prove quite as acceptable to boards of health and to the public in general, for whom such analyses are often made, as if presented in the mixed and irregular forms commonly adopted.

The committee also feels sure that the people in general are better able to form a definite idea of the character of a water from a report stated in parts per 100, parts per 1,000,000, etc., than from one expressed as grains per gallon, the latter being a ratio wholly unfamiliar to any but those in the medical or pharmaceutical professions.

A. C. PEALE, M.D.
WM. H. SEAMAN, M.D.
CHAS. H. WHITE, M.D.

PARIS LETTER.

MANY interesting scientific events have lately attracted attention here. The limits of my present letter will not permit me to speak of them all, and I will therefore confine myself to the most important ones.

The appointment of Mr. Mathias Duval to the professorship of histology in the medical school is one that does not meet entire approval. Mr. Duval is certainly an able man, and one much liked by his students; but it cannot be said that he is well fitted for the task he has assumed. He is much more proficient in anatomy and physiology than in histology. It had been hoped that the faculty of medicine would appoint to this professorship an histologist of known reputation, such as Mr. Malassez. There will be, however, one good result of Mr. Duval's appointment: histology will undoubtedly be taught in a clear and precise manner, which had never been the case under C. Robin's instruction. Mr. Duval is an excellent *vulgarisateur*, and thoroughly understands teaching. His students will certainly learn histology much better than they have hitherto.

With this accession to the faculty, however, the resignation by Mr. Vulpian, of his appointment as *médecin des hôpitaux*, is much regretted by his pupils. His reasons are not very well known. It has been stated that he did so in order to devote more attention to his patients; but the truth is, he has not much practice, and the greater part of his time is given to laboratory work. He has recently been asked to accept the appointment as *secretaire perpétuel* of the Academy of sciences, in the event of Mr. Jamin's death (which occurred yesterday), and it may be that he has thus sought opportunity to devote himself to this very absorbing task by resigning his other arduous occupations.

Mr. Paul Bert took his departure from Paris for Tonquin yesterday evening. Monday last he made a speech at the meeting of the Academy of sciences, bidding adieu in rather pathetic tones. The academy, however, reciprocated neither his real or assumed feelings nor his speech. One cannot but wonder at the general approval of Mr. Bert's mission to Tonquin. He himself is overflowing with happiness. His friends are sure he will do well, and be of use in Tonquin. His enemies — and they are not few — are convinced that he will commit some great blunder, and kill himself politically. They, however, feel a great relief in the fact that they will be rid of him for some time. Everybody is satisfied, even the Academy of sciences, who listened to his last speech with much coldness, as though to impress upon him their lack of interest in politicians. It certainly is a strange and unusual occurrence, in France at least, for a scientific man to become a politician, though it must in justice be said that Mr. Bert is a man of much intelligence; and, should he fail, it will be due rather to his temper than to his lack of ability.

A new French scientific periodical, the *Archives Slaves de biologie*, has recently made its appearance. It is published by Messrs. Richet & Mendelssohn, and will be devoted to the more important scientific works that are published in Russian, Tcheque, and other kindred languages. It will comprise original communications in French, or translations from the Russian, with reviews of the latest works on biological sciences in general. The first number contains more than three hundred pages of large octavo size, including original memoirs by Fritsch, on recently discovered human crania; of Godlewski, on Pocta and Wierzejski on fossil and living sponges; of Danilewsky and Kowalewsky, on Nawalichin and Botkine; and of many others, on various medical and physiological subjects. The remaining pages are filled with reviews and critical notes on the recent biological work in the Russian and kindred languages, from such writers as Mendelssohn, de Varigny, Danysz, Halperine, and others. The project is certainly a very commendable one, to thus gather up in a single journal all the scientific work of a country; and in this particular case the idea is all the better, from the fact that Slavonic *savants* do not all write in the same language, and that their scientific papers are not commonly met with. It is very likely that the periodical will be successful, filling as it does such a useful field. The example of the

Archives Italiennes de biologie is certainly encouraging, and we doubt not that the present journal will be as favorably received.

The unveiling of Claude Bernard's statue, erected in front of the College de France, took place some days ago. The ceremony was attended by very few persons, owing to the inclemency of the weather. Addresses were made by Mr. Berthelot, Mr. Renan, Paul Bert, and Mr. Dastre. Mr. Renan is of a very humorous turn of mind, and has a way of causing amusement at the expense of others, — a way that is very pleasant when it does not concern one's self. Speaking of P. Bert as one of the pupils of Claude Bernard, he said that Mr. Bert would also have his statue, some day or other, near that of Bernard. Mr. Bert took this in all seriousness, and with much thankfulness, thinking that he certainly deserved this honor. All except himself, however, perceived the point of Mr. Renan's remarks. Jokes should not be too refined; otherwise they may miss their mark, as did the present one. The best addresses were those of P. Bert and Mr. Renan. That of Mr. Berthelot was rather long, and Mr. Dastre did not say any thing new or interesting.

A month or so ago I had the opportunity of seeing Mr. Chevreul at the meeting of the French academy, where Bertrand was pronouncing his *discours de réception*, which was answered by Pasteur. Mr. Chevreul is very well preserved, and does not appear as old as he really is. He had an inclination twice or thrice during the meeting to take a little nap, but he struggled successfully against it. One or two allusions to his old age, and to his long, fruitful career as a chemist, received much applause. A person who has known him well for a long time says that he is certainly not weaker in intellect than he was eight or ten years ago; but, contrary to the general fact that old people recollect better, events that have transpired during their youth than later ones, Mr. Chevreul speaks only of his experiments on colors, not caring to talk at all of his very important and useful discoveries on the *corps gras*, on soap, candles, etc., which he seems to forget. V.

Paris, Feb. 13.

NOTES AND NEWS.

MR. PASTEUR, according to a telegram to the New York *Herald*, read on Monday last a paper before the French academy of sciences, giving the results of his methods of treatment for hydrophobia. Three hundred and fifty persons have been treated, including twelve Americans, all of them successfully, except one, who was not brought to the laboratory till thirty-seven days after having been bitten. During the six years preceding 1885, in the department of the Seine, 517 persons had been bitten by mad dogs, from which there resulted 81 deaths, or about one out of every six bitten. It is proposed to open an international establishment at Paris for the inoculation treatment, and already funds are being largely subscribed.

— The dog by which the Newark children, who were sent to Paris for treatment, were bitten, was evidently not mad. The dog, it will be remembered, was killed at the time; but seven others which were bitten by it have been kept under the closest surveillance, and have shown no indications whatever of hydrophobia. They have been released.

— In our issue of Feb. 19, in mentioning Miss Crocker's 'Methods of teaching geography,' an unfortunate slip of the pen made us give Miss Hale the credit of its authorship. It was written by Miss Lucretia Crocker, and is in every way a most creditable piece of work.

— The 'Forum' (New York, *Forum publishing Co.*) is the title of a new monthly magazine, edited by Lorettus S. Metcalf, the former managing editor of the *North American review*. The magazine will address itself to the mass of intelligent people, and will discuss subjects that concern all classes alike, — in morals, in education, in government, in religion. The first number, for March, contains articles by Prof. Alexander Winchell (on Science and the state), James Parton, E. P. Whipple, Drs. R. H. Newton, E. E. Hale, A. Cleveland Coxe, W. A. Hammond, M. J. Savage, and Howard Crosby.

— A new polar expedition, says *Das Ausland*, under the leadership of Dr. Bunge and Baron Toll, has been organized for the zoölogical and topographical investigation of the islands of New Siberia. The expedition will reach its destination the coming spring.

— The American economic association held a business-meeting in New York, Feb. 27, President A. Walker in the chair. The next meeting will be next autumn, at a date not yet fixed upon.

— A bill limiting the hunting of deer or the sale of venison in the state of New York to the period between Aug. 15 and Nov. 1, has been passed by the assembly. The bill also prohibits the transportation of dead deer by railroad companies, except that the bodies of two deer killed by a sportsman may be taken to his home by him in the limited period stated.

—The *Naturwissenschaftliche rundschau* (Braunschweig, *Vieweg & Sohn*) is a new eight-paged

weekly periodical, devoted to the 'gesammtgebiete der naturwissenschaften.' The first numbers are mostly filled with abstracts and reviews.

— The London *Daily telegraph* states that an effort is at last being made to disinter the Sphinx. The work of exhumation is intrusted to Brugsch Bey, brother of the distinguished archeologist, who will carry out a plan formed by Signor Maspero. About 20,000 cubic metres of sand must be cleared away. To expedite this task a little tramway has been constructed, and 150 laborers are engaged for the more mechanical portion of the toil. About Easter the work is expected to be completed. Then, when the rock out of which the statue has been hewn is laid bare, a broad circular walk will be constructed around it, and a high wall built to guard against future encroachments of desert sands.

— A correspondent of the New York *Herald* says that it is very probable that Mr. Rousseau, who was sent by the French government to inspect the Panama canal, must report that the present enterprise is inevitably to be changed from a sea-level canal to a canal with locks, if it is ever to be finished by the present company, thereby not merely falsifying M. de Lesseps's assurances a hundred times reiterated, but also the very basis of the preference given to the Panama route over that of Nicaragua. Regular subscriptions to the funds are exhausted, and it is proposed to raise a hundred or more million dollars by a national lottery.

— It is expected that the Grecian canal, connecting the gulfs of Corinth and Aegina, will be completed by the end of the present year. The canal will be less than three miles in length, but the deepest cuttings are nearly two hundred and fifty feet in depth. The canal will admit the passage of the largest ships, and will shorten the sea distance between the Adriatic and the levant a hundred and thirty miles.

— In a recent paper the eminent French *savant*, Alphonse de Candolle, reproduces with approving comments the arguments of Prof. A. Graham Bell upon the production of a race of deaf-mutes in the United States. In commenting upon the methods proposed to prevent this result, he adds that the English language is the least favorable of all for spoken use among deaf-mutes, as the movements of the lips are more often replaced by an accentuation or intonation that does not produce any visible effect. The vowels are articulated less clearly than, and are not so sharply differentiated from each other as, in the other chief European languages. The French has very few words, such as *de* and *crac*, in which the lips do not take part in the pronunciation, while in English numerous sounds, as of *n*, *th*, and *h*, are formed almost wholly by the action of the tongue. This is confirmed by the experience of intelligent deaf-mutes. Mr. Candolle suggests, in addition to the views of Professor Bell, that, independently of deaf-mutism, marriage between first-cousins should be wholly prohibited. He also asks whether greater care given to new-born infants would not materially diminish the number of deaf persons.

— A new edition of 'Berghaus' physikalischer atlas' is announced, to be completed in twenty-five *lieferungen*, the first of which will appear about the middle of the present month. The work is prepared wholly anew, by the co-operation of Drs. Drude, Gerland, Hann, Hartlaub, Neumayer, and Zittel.

— The bird-destroying 'slung-shot' boy is not an eastern innovation. A writer in the Santa Barbara, Cal., *Press* deplores the evil that he has grown to be in the west, in the destruction of the native birds for millinery purposes.

— The following works are announced by the Smithsonian institution to be now in press: 'Scientific writings of Joseph Henry;' 'Flora of North America,' by Asa Gray; 'Guesde collections of antiquities,' by O. T. Mason; 'Annual report for 1884;' 'Paleontological bibliographies,' by J. B. Marcou; 'Bulletin of the Washington philosophical society,' vol. vii., for 1885; and the different reports of progress in 1885: viz., in chemistry, by H. C. Bolton; in geography, by J. K. Goodrich; in seismology and vulcanology, by C. G. Rockwood.

LETTERS TO THE EDITOR.

Oil on troubled waters.

ONE of the most curious things in connection with the use of oil on troubled waters is the frequency with which it appears as a new discovery. Those who would dismiss the subject with a contemptuous sneer at the credulity of people imposed upon by sailors' yarns know little of the prolonged attention the matter has received in the past, and of the honored scientific men who have studied the problem. There is no room here to quote the many observations at hand, but only to sum them up, and to present the explanation that has met with most favor.

The earliest reference at hand in English is found in Cavallo's 'Philosophy' (fourth American edition, 1879, p. 209). The author points out that oil spreads 'instantly' over water; that the wind has little effect in raising waves on the surface of oil, or of water covered with a film of oil; and that from early times this fact has been utilized in stilling the waves of the sea. The experiments of Franklin and others are cited.

In Gehler's 'Physikalisches wörterbuch' (Berlin,

1837, band vi. p. 1750 ff.) there is a good presentation of the subject, and many facts are cited. Most of them are drawn, however, from the thirty-page discussion in Weber's 'Wellenlehre' (1825). Here one finds quotations from Aristotle, Plutarch, and Pliny, which show that in early times the power of oil to quiet, and so render more transparent, the surface of water, was known. References are made to other and later writers, and to the facts collected by Franklin; and details are given of experiments made by him (Phil. trans., lxiv., 1774), and later by the Webers.

From all these data, as well as from the recent observations reported in *Science* (especially vii. p. 134), it seems that the effect of the oil-film is to diminish the 'combing' of the waves, and to prevent, in part at least, the formation of small waves, and the growth and sharpening of the crests of the large ones by the continued action of the wind. The exaggerated popular notion that the great waves are quieted seems to be erroneous. The only known ways of destroying in the open sea the energy of a wave once formed are by fluid friction, by rain, and by an opposing wind. But we must not underestimate the advantage of preventing the piling-up, on a wave already dangerously high, of another only a few inches high. On the well-known principle of superposition, it must sometimes happen that the crests of waves belonging to two or more systems will coincide. The resultant wave is then higher, and exposes more surface to the wind: and the crest, being sharper, is more easily blown off by the wind: so, as the wave is likely to run faster than the ship, it may break over her in a way that would not happen if it were only a little lower,— if only one of its smaller components could be suppressed.

It is further to be borne in mind, in seeking an explanation for the indisputable and useful effect of oil, that, as the passage of a wave is the transfer of energy but not of matter, the oil will not be carried onward by the wave; and that, if the formation of new waves over a given large surface could be prevented, the old ones would speedily pass out of it, and those coming into this surface from beyond would not be increased, but would decrease somewhat, because of the fluid friction.

The practical problem, therefore, before the shipmaster, is to find some means, 1°, of preventing the formation of new waves, or the growth of old ones, over a given surface to the windward of his ship, and, 2°, of making this surface as large as possible. He solves it more or less completely by the use of oil; and now we seek an explanation of the action of oil from the physicist.

The German physicists of the first part of this century followed pretty generally the view attributed originally to Aristotle, and elaborated by Franklin; the Webers subscribe to it; and Müncke, in 'Gehler,' says it is generally held: in a word, the friction of the wind is less on the oil than on the water. Stated in this way, however, the sentence is almost sure to convey a false impression. We know of absolutely no proof that this is true, if taken with its obvious meaning; but the truth it embodies is simply, that, owing to the interposition of the oil-film, the force of the wind is not communicated to the water; and this can be explained in a way consistent with modern physical notions. Franklin had pointed out how a ripple raised by the wind gets higher, broader, and longer at each successive vibration [and therefore travels faster]: he compares the effect of the wind to the setting of a heavy church-bell to swinging, by properly timed impulses of a finger. He thinks the adhesion between the oil and water is so slight (if, indeed, the repulsion be not strong enough to maintain the film at a small distance from the water) that the film can be moved a little by the wind without disturbing the water. He suggests, further, that the wind can 'catch' hold of the large wave better when this is covered with ripples, while, if it be oiled, the wind may press it down. The Webers add something with reference to the resolution of the force of the wind, which seems not quite sound in theory; and Müncke has something to say about a slight binding of the surface of the water by the oil.

But some properties of fluids unknown to the earlier physicists have a bearing on the present problem. Thus Daniell, in his 'Principles of physics' (p. 247), says, under the title 'Superficial viscosity,' "To the same cause [superficial tenacity] we must attribute the smoothing of the surface of a rough sea when oil is poured upon it: the new surface has great superficial tenacity and small superficial tension, and is not readily broken up into surf." The bearing of this may be shown thus. Imagine a perfectly calm lake: a wind strikes it, and it is covered with wavelets. It is not the increase of pressure over the lake that causes the waves, but slight differences of pressure between neighboring points, due to the fact that the winds flow more or less in gusts, not steadily. If the surface were solid, or very viscous, like mucilage or thick oil, the momentary force due to the difference of pressure would cease to act before any sensible movement could take place. The effect would be the same in kind, though differing in amount, however thin the film, or slightly viscous the oil may be; but we should remember that the superficial viscosity which is effective here is usually greater than the viscosity calculated from experiments where a considerable volume of the liquid is used. The effect, too, would be the same in kind, though the sea were rough instead of calm. We see, then, that an oil-film, by its viscosity (as well as by slipping over the water, if Franklin's view is correct), delays the action of the wind's force on the water for so long a time, that the force may have ceased to act before any movement begins, and then no work is done by the wind on the water. Thus, in an extreme case, no new waves are formed, and those driven on by the wind through the oil-covered surface do not have their crests continually elevated and sharpened till they are ready to break.

What might happen in an extreme case does happen, to some extent, in every case where oil is used on the water. Thus the wake of a ship generally shows a surface covered with bubbles more persistent than usual, and comparatively free from small waves, both effects being probably due to the traces of oil coming from bilge-water, the cook's galley, etc. Where a ship is driven before the wind, and the waves are running faster than the ship, if oil is being used, it is evident that the wind has to pass over a long oil-covered surface, and the effect of the oil will be especially favorable. Since it is essential to this explanation that the oil be spread to the windward, little benefit is to be expected from the use of oil on waves coming from a distant storm; nor when the wind is ahead, unless means can be used to throw the oil a long distance ahead.

If this explanation be correct, as we believe it to

be, there is no violation of the fundamental law of modern physics,—no destruction of energy.

The second practical problem is to cover as large a surface as possible with the viscous fluid. Fortunately this can be done easily in accordance with principles explained in many modern treatises on capillarity: for the surface tension of the film between water and air is so much greater than the sum of the tensions, oil-water and oil-air, that a drop of oil is very rapidly drawn out over an enormous surface. If this paper were not already so long, some numerical data might be given. The preference shown for animal or vegetable oils over mineral oils (*Science*, vii. 133) is probably justified by the smaller surface tension and greater viscosity of the former; though it may be noted, that, the greater the viscosity, the slower the oil will spread, other things remaining the same.

To render complete the explanation of this interesting and at first sight puzzling action of oil, experiments are needed by physicists in the laboratory, where for various oils the several physical properties above named shall be measured, and also experiments and observations at sea when wind and waves are moderate enough to be measured, and the captain may go in any desired direction without danger. A few days' observations, where the conditions can be controlled, would be worth hundreds of the desultory reports which the hydrographic office is wisely collecting. CHARLES K. WEAD.

Professor Thorell and the American Silurian scorpion.

Professor Thorell, who is perhaps the best authority upon the Scorpionidae, both recent and fossil, has rather severely taken to task some of my statements and determinations in connection with the recently discovered American Silurian scorpion (see *American naturalist* for March, 1886, p. 269). In fact, so sharp and pungent are some of his remarks, that a person reading them would naturally infer, that, in Professor Thorell's opinion, I was hardly capable of making a reliable observation, at least not upon a scorpion. He has shown his good nature, however, in the outstart, by admitting that the specimen is really a scorpion, and not a Eurypteroid,—a conclusion the exact contrary of that jumped to by one critic upon reading the first announcement of its discovery. For this concession Professor Thorell has my heartiest thanks. In his further criticisms, however, he is much less lenient, and I wish to briefly notice his objections in their order.

After making the above-mentioned admission, Professor Thorell proceeds to deal with the six ventral plates of this, what he calls, 'rather badly preserved fossil.' In my description in the American museum bulletin, I mention that the specimen is 'greatly compressed;' that the 'dorsal crust is preserved over about two-thirds of the surface,' mentioning the parts; and that "over the rest of the prae-abdomen and what remains of the post-abdomen or tail, parts of the first five segments, the inside of the ventral crust is exposed." This feature of the specimen has, I fear, misled Professor Thorell, and caused him to fall into an error, into which, if he had known the nature of the preservation of the fossils (Eurypteroids) found in the formations from which the scorpion was obtained, he probably would not have fallen. The specimen is greatly compressed vertically, as are all the fossils in the same rock. Along the left side of the abdomen there is a line of fracture, to the right of which the substance of the dorsal plates, and the filling between them, to the ventral plates below, has been removed in splitting the rock, and probably left on the other part. Along this line the thickness between the two sides of the fossil (dorsal and ventral) is about a twentieth of an inch or less. In speaking of this feature, Professor Thorell says, "The whole upper side of the abdomen is broken or cracked longitudinally," and that the articulations of the ventral parts are "all direct continuations of the articulations between the dorsals." Neither of these assertions is entirely true. The abdomen is partially removed, but not 'cracked' in the sense in which he uses the term; and the articulations between the joints of the ventral plates are not 'direct continuations' of those of the dorsal. Besides this, the overlapping of the plates show directly which is dorsal, and which is ventral; and no zoölogist would be apt to make the mistake. If we examine the abdomen of a beetle, roach, or scorpion, on the exterior, we find the anterior plates all overlapping those behind, both dorsally and ventrally: but, if we take off the crust and examine the inside, we find the reverse to be the case; that is, the anterior edge of the plates overlaps the one anterior to it. Now, this is precisely what is seen on this specimen: on the left side the anterior plates overlap those behind, while on the right side the posterior overlap those in front: and the surface of the plates is concave, while on the left side they are convex; so that a mistake is nearly impossible. Professor Thorell's statement, that, if his interpretation of this character is the right one, "the want of spiracles on the plates needs no further explanation," is therefore of no value, as he reasons from false premises: all his conclusions based upon his assumed features fall to the ground, and the want of spiracles is yet unexplained. There are six of these ventral plates plainly seen, extending from beneath the dorsals. Neither is the specimen a 'rather badly preserved fossil,' but instead an exceedingly well preserved and distinct one, as far as the parts existed when the specimen was embedded.

In a footnote to his observations on the above structure, Professor Thorell states, that, "even if the plates in question really were ventral plates, the first (or sixth when counted from behind forward) would seem, from its position, to correspond to the anterior half of the first ventral in the ordinary scorpions, and not to the small plate situated between the pectoral combs." On this statement I will make no comment, further than to say that I have failed to find, in the living species which I have examined, any case where the first (or anterior) ventral plate is even apparently articulated to the third ventral plate, or has the lateral width of this one.

Professor Thorell next goes on to say that "Mr. Whitfield thinks, that, whereas modern scorpions carry the tail (post-abdomen) arched upward over the back, Proscorpius, and also Palaeophonus, carried it in the opposite way, or curved downward." He says, "This would indeed be a character of fundamental importance for distinguishing the Silurion scorpions from all other members of the group," but that to him it is "impossible to find any stringent reason for adopting this strange hypothesis," and that it would cause "the animal's gait to be exceedingly difficult and awkward if it were to walk

with its tail curved under its body." I never intimated that it walked with its tail curved under its body; this is his own suggestion: but I cannot see why the animal might not walk with its tail straightened out behind, as well as to curve it over the back; in fact, the latter position seems much the more awkward of the two. As to stinging its prey after having caught it between the hands of its palpi, it might experience a little trouble: hence the necessity of the development of a more elevated feature by way of adaptation of parts to purposes. There must be a period in the life of a scorpion when the tail first assumes this elevated feature; for as Professor Thorell admits, just before birth in the living forms, the tail is curved downward. If the bend is downward then, when is it turned upward? and why, in these early forms, might not this embryonic feature be prolonged to a later or more advanced age. Wasps and similar insects bend their bodies downward in stinging their prey, and are not particularly awkward, as I have often experienced. The ridges on the upper and lower surfaces of the tail-joints differ in all living scorpions which I have examined, and readily show which is dorsal, and which is ventral. Those seen on this specimen have the character of the ventral or lower side (inside as to curvature), and not "the same form and sculpture of the dorsal plates, or parts of these segments or joints in ordinary scorpions," as Professor Thorell wrongly asserts. They diverge at the anterior end, and converge at the posterior end. The very slight displacement of the tail segments is not sufficient to warrant the assumption that the entire tail has been turned over, although such may possibly be the case, but is not at all probable. I stated the fact of displacement in my description, and based my reasoning upon the improbability of its having been turned over. Of course, if it is turned over, my inferences are faulty. But has it been? I think not.

Professor Thorell next attacks the two poor little claws in the most pitiless manner, notwithstanding the animal has but one foot to show. This he holds out in the most appealing manner to the observer, entirely distinct, and free from interference by the other limbs, and with the two claws widely spread, as if in an effort to prevent disputation. Professor Thorell's remarks, in his effort to reason away one of these claws upon an assumption as to what a Silurian scorpion ought to be, partake so much of the character of 'special pleading,' that I do not feel called upon to make a very extended attempt at refutation. The specimen is so very distinct and positive in this respect, that I shall only say, in reply to Professor Thorell, that he can rest assured the specimen is not broken, or in any way mutilated in this part; that there are certainly two processes of almost equal size, the longer being only perceptibly narrower at its base, under a high magnification, than its mate; that the two processes are situated on the end of the joint behind, and not on the side of the end, in the position of a spine. Now, these processes he can call spines, or parts of a broken limb, or by any other name: they still remain claws to every appearance, are in the right position, and were undoubtedly used as such by the animal. In my examination of the specimen, I have made no assumption and manufactured no feature, simply taking the specimen as it is, without tinkering or dressing. I have had, in the matter of the double claw, the opinion, after examination, of many good observers, only one of whom failed to assert positively the existence of a double claw. That one exception, after a very cursory examination of only a very few minutes, gave no direct opinion.

After speaking of the transverse furrow across the base of the cephalothorax, Professor Thorell mentions '*the small size of the eyes*' as a feature in which this specimen differs from the Eoscorpionidae, and states that "in this particular it more resembles Dr. Hunter's and Mr. Peach's Scotch Paleophonus." I am not aware that the eyes of Dr. Hunter's and Mr. Peach's Scotch Palaeophonus have been actually observed so as to know their exact size. The specimen lies with the ventral side up, the eyes being embedded in the rock below, but, according to Mr. Peach, "are seen pressed up through the cuticle of the gullet," and would naturally appear somewhat larger than they really were in life, owing to the lifting of the cuticle over them. Consequently I do not see the force of the comparison.

Professor Thorell believes Proscorpius forms a 'good peculiar genus,' as "characterized by the somewhat trilobed anterior margin of the cephalothorax," — a feature which I should not consider as of more than specific value,—"and more especially by the shape of the fingers of the mandibles, which, if they really had such a form in the living animal as they, from Mr. Whitfield's figures, appear to have, differ materially from those of Palaeophonus and all other known scorpions." I am sorry Professor Thorell has not told us how they differ; then we should have had a basis of comparison. My figures of the mandible, three of which I gave, besides that in place on the enlarged figure in plate 19 (which, by the way, is not a drawing, but a print direct from a photograph of the specimen), were given to show the uncertainty of this part. They can be verified, however, by reference to that figure.

As to Professor Thorell's opinion of the systematic position and relation of this American fossil scorpion, which he has based upon a lack of knowledge of the specimen, and the assumption of characters and faults which it does not possess, I shall say nothing, as it rests entirely on the existence of a single or double claw. But as to his "additional reason to those given above for removing Proscorpius from the carboniferous Eoscorpionidae, and for referring this genus to the Apoxypodes, fam. Palaeophonidae," which he says "may be found in its being, geologically speaking, almost contemporary with the Palaeophoni," I should object to make geological position even an 'additional reason' for zoölogical classification.

Regarding the aquatic nature of the animal, there can be no certainty. The apparent total absence of stigmata, yet unexplained, leads one to inquire how they breathed, even if aquatic. The same may be asked of its aquatic associates in the rock, Eurypterus and Pterygotus, which show neither stigmata nor branchiae; but their aquatic character is not questioned. That it should be any thing so 'very strange,' that a connecting-link between a small and a large form, like the scorpion on the one hand, and the Pterygoti on the other, should be found in "such a little creature as the Proscorpius Osbornii," I think few will admit; nor are all the Eurypteri and Pterygoti so very 'gigantic' as his language would indicate.

R. P. WHITFIELD.

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The language of the Bilhoola in British Columbia.

The Bilhoola tribe inhabits the district of Dean Inlet and Bentinck Arm, and is surrounded by tribes of the Kwakiool family. Their language, as those of the neighboring tribes, is very little known: therefore the following remarks, imperfect though they be, may be of interest. The material was collected by me from some individuals of this tribe who were brought to Germany by Capt. A. Jacobson, and staid for a fortnight at Berlin.

The most remarkable peculiarity of the language is, that words in connection cannot be expressed except by the help of certain prefixes much resembling an article. The most common of these are *ti* and *ua*. For instance: 'large,' *shg* (*sh* pronounced almost like *ch* in the German *ich*); 'stone,' *t'ht* (*h* like *ch* in the Scotch *loch*); 'large stone,' *ti shg ti t'ht*.

The plural of nouns is formed in different ways, either by reduplication of the initial sound or by the ending *uks*. In some instances I found *pi* and *tj*. Frequently the singular serves also for the plural. It seems that the cases are only expressed by the position of the word in the sentence.

The personal pronoun is —

SINGULAR.		PLURAL.	
1*st person*,	ens	1*st person*,	th 'mitl'
2*d* "	ino	2*d* "	th 'optl'
3*d* "	t 'aish	3*d* "	t 'auts

The possessive pronoun is formed in two ways: it is either derived from the personal pronoun, and connected with the noun by *ti* in the singular, and *ua* in the plural (for instance: *enstl 'ti t'nah*, 'my head;' *th 'mitl 'ua sotl'*, 'our house'), or it is expressed by a suffix (*t 'nah-stsh*, 'my head;' *sotl 'tlsh*, 'our house').

The flexion of the verb is quite remarkable. It is either formed by a personal pronoun and the stem of the verb, both being connected by *ti* or some other prefix, or by suffixes. Besides, the pronoun can be repeated after the verb: for example, —

ens ti tl 'ap
th 'apsts } 'I go.'
th 'apsts ti ens

The suffixes are identical with the possessive suffixes of the noun.

The objective flexion of the verb bears the features of having originated by agglutination of the pronoun to the verb; for example, *ksh'*, *sh sino*, 'I see you;' *ksh 'sh titl*,' 'We see them.'

I could not find any distinct traces of the tenses being expressed by suffixes or by prefixes. An iterative is formed by the prefix *atl'*; a locative, by *nu*.

The principal colors are red, yellow, and blue, the limit between the latter two being indefinite. Green is sometimes called yellow, sometimes blue; viz., similar to the one or the other.

The names of the numbers are formed according to the quinary-vigesimal system: 6 is 5 + 1; 11 is 10 + 1; 20, one man, i.e., the number of fingers and toes; 40, two men, etc.

The vocabulary bears only a very slight resemblance to that of the Kwakiool and the Selish. As far as I know, the grammar much resembles that of the Bilballa.

The traditions and customs of this people are almost identical with those of the Tlinkit and their other neighbors, though in their details there may be some differences. FRANZ BOAS.

Berlin, Feb. 5.

Discomforts arising from sponge spicules in pond-soils.

Near Monticello, in this state, are numerous ponds and sloughs, many of which have been drained and brought under cultivation. The soil is of the typical humus character, containing no clay and but very little sand. For ages, perhaps, each summer has produced its rank growth of aquatic plants, and each autumn has laid this growth beneath the rippling surface of the pond, to be protected from thorough decomposition by its waters: consequently, when the hand of improvement removes the water, a rich bed of vegetable matter is brought to the sun and air. Such situations are peculiarly favorable for the cultivation of corn, and large yields may be produced; but in the cultivation of the crop a most annoying difficulty is encountered. In bright, warm days, the workmen in these fields experience a distressing itching in those parts of the body where there is rubbing or chafing of the boots or clothing. I cannot better describe this sensation than by comparing it with the pain occasioned by the attack of a flock of mosquitoes upon the affected parts. It is almost unbearable, and some persons are obliged to stop work and seek relief. Usually by taking a bath and cooling the body the irritation ceases; but, if it again be heated by over-exertion, the pain is renewed. Such a condition will last for about two days.

On microscopic examination, we found among the particles of sand and vegetable matter numerous spindle-shaped, sharp-pointed bodies. Some were hooked and curved; some broken in the middle, making one end blunt; some were covered thickly with spines. These have been identified as diatoms and fresh-water sponge spicules. The bodies are of a siliceous character, for they are not destroyed by ignition, nor attacked by hydrochloric acid. Since fresh-water sponges are quite abundant in many ponds, their remains form a conspicuous part of the soil.

Having thus ascertained the cause of the irritation, it is not difficult to understand its production. A fine impalpable dust always rises from the soil when it is being cultivated. This penetrates the clothing, and finds its way to those parts of the body where there is friction between the skin and clothing. The backward and forward motion of the cloth causes the spicules to work their way into the skin far enough to irritate the nerves and produce the pain. The increased circulation due to active exercise increases the sensitiveness of the skin, and hence the pain is greater under such conditions.

No remedy has as yet suggested itself. The best preventive is wearing such clothing as will most nearly exclude the dust. As the spicules are composed of one of the most enduring substances, they will not be removed from the soil by the usual changes taking place in it. Wind and cultivation may disseminate them so that they will be far less troublesome, but it will be a slow process. Altogether, the outlook for the comfortable cultivation of these pond-soils is not encouraging; and, if the large crops which they are capable of producing are obtained, much annoyance and inconvenience must be endured. S. T. VIRDEN.

Purdue university, Lafayette, Ind., Feb. 20.

Preliminary description of a new species of Aplodontia (A. major sp. nov., 'California show'tl,' 'mountain beaver').

I have received from one of my collectors eight specimens of a new species of Aplodontia captured in the Sierra Nevada Mountains, in Placer county, Cal. It may be distinguished from the only previously known species of the family by the following diagnosis: —

Length, about 400 mm.; hind-foot with claws, about 60 mm.; height of ear, about 8 mm.— Pelage, comparatively coarse and harsh; hairs of flanks, elongated beyond those of the surrounding parts, forming on each side a more or less pronounced oval patch, from 60 to 80 mm. in length and from 40 to 60 mm. in breadth, which terminates abruptly about opposite the hip joint, and which is most marked in specimens not fully adult. *Color:* Whiskers, black; back, grizzled grayish-brown, the tint of the brown being that of a dilute bistre; hairs at base and under fur, very dark plumbeous: rump and belly, grizzled mouse-gray, sometimes faintly and superficially washed with very dilute brown; a distinct patch of white in the anal region; tip of nose, sooty-brown, which color sometimes extends backwards in a narrow stripe almost to a point midway between the eyes. *Cranial characters:* The skull is much larger and heavier than that of A. rufa, and the occipital crest is more highly developed; the zygomatic arches are more bowed outward; the nasal bones are broadest at or near their anterior ends instead of some distance posteriorly; and the ratio of the upper molar series of teeth to the basilar length is decidedly less than in A. rufa.

There are several other cranial differences which will be discussed at length, together with the animal's affinities with 'var. Californicus' of Peters, in a paper soon to be published.

C. HART MERRIAM.

International copyright.

While always an enthusiastic advocate of an international copyright as a matter of abstract justice to British authors, I have never been able to satisfy myself of the constitutional right of congress to enact a separate bill for the purpose of effecting one.

The constitution of the United States is a grant of power. Among other powers granted by it to congress is (art. I., sec. 8) that of promoting "the progress of science and useful arts by securing for limited times to authors and inventors the right to their respective writings and discoveries." This congress has already done. The question now presented is, therefore,

1. Has congress exhausted such powers under the constitution, and, if not, has it still power to legislate as to the degree of protection accorded authors and inventors, by enacting a statute to protect British authors, which statute (let it be admitted) will indirectly increase the profits of the American 'author and inventor'?

This question being disposed of, nothing further need be said as to the power; but a word might be added as to the merits of the question.

2. It is one of the legal necessities of our imperfect state that every individual, in selecting his vocation, assumes and subjects himself to the risks and dangers of that vocation; as, for example, an employee of a railroad company, other things being equal, cannot recover of the company for injuries received in the course of his legitimate employment by it. Now, the author, in selecting authorship as a vocation, accepts a risk which may, perhaps, be stated categorically; viz., while it is doubtless true that, 1°, an idea is property, it is equally true that, 2°, the form of words in which an idea is expressed is also property; but it is absolutely impossible to protect the idea when unclothed in words. The utmost the law can do is to protect the expression of the idea.

Now, the disability — the risk and danger of authorship which the author accepts — arises from the fact that it is possible to clothe an idea in any number of different forms of words. Let us suppose that A expresses an idea, absolutely original with himself, as follows: 'The sun gives warmth to the earth.' Let us suppose that B sees this in print, and steals it deliberately, putting it thus: 'The orb of day diffuses its heat over our planet.' It is evident enough that no statute or court can refuse protection to either or both A and B: for no court could try the question of priority of the abstract conception, and, even if it could, it could not protect that abstract conception separated from a statement of it in words; and B's statement is in words as well as A's. To obtain a patent, an oath and a contract are necessary. The applicant must first make oath to the originality of his invention, and, secondly, make a contract with the government; viz., that, on his part, he will fully and frankly state in his specifications the methods and processes by which he produces useful results, so plainly that anyone understanding the language could do the same, and that in exchange for these specifications, the government, on its part, will accord him a limited protection in the use of them for the inventor's sole profit. But the author of a poem, novel, or treatise, makes no oath of originality, and enters into no contract. He merely states the name and makes profert of his production; and the government takes notice, and shifts the burden of proof in his favor; that is to say, provides, that, if the author thereafter sue for an infringement, he need only plead his copyright, while it is for the defendant to attack.

It was this course of reasoning which led me, ten years ago (in a treatise on the laws of copyright), to say, that, unless there could be devised a law against paraphrase and plagiarism, copyright statutes were of very little practical importance, since a paraphrase of a work was fully as much entitled to copyright as the work itself. Is international legislation expedient to protect property so practically *publici juris?*

There is another phase of the question which I certainly do not care to press, but on which a consensus of opinion might be unfavorable to a statute of international copyright with England (though not, of course, with France, Germany, or other non-English speaking nations).

3. Is there any citizen of the United States, not at present a writer of poems, novels, or other literary matter, who would become one if there were an international copyright with England? Of course, if we can demonstrate that the divine call to write poems or novels is at present largely suppressed in our people by fears that they will be obliged to publish at their own expense, or that publishers will only pay them ten per cent; if it can be proved that this nation is suffering, and *in extremis,* for lack of

poems, romances, or general reading-matter, — it is the right and duty of congress, under the general urgency clauses of the constitution, to at once enact statutes for the public welfare and relief.

It has never been denied, I think, that, in times of great dearth or stress or suffering, extraordinary powers can be construed into that clause, for the general good of the whole people.

It seems to me, however, that there is no doubt possible but that congress would have power to simply amend its present copyright act by substituting the word 'person' for the words 'citizen of the United States,' which would at once give a perfect and absolute international copyright, and the best one possible; since any new and separate act would at once be brought before the courts for construction, whereas the word 'person' could hardly need judicial interpretation. This was the plan suggested by me in 1875, and I have seen no reason to depart from it since. APPLETON MORGAN.

A recent ice-storm.

In answer to the question of Mr. W. M. Davis, printed on p. 190 of *Science* (vii. No. 160), I would suggest the following, deduced from observations of the effects of many similar storms, though the particular storm referred to, of Feb. 11–13, did not trouble the trees so much in this neighborhood as farther inland and farther north; for the temperature near Boston was not quite low enough to form much ice at that time.

Pine-trees make branches nearly at right angles with their trunks, and these branches become more and more pendant in their habit as they grow older. It follows, that, when an old tree is loaded down with ice, the branches can bend downward till they rest part of their weight on those below, and the lowest ones on the ground, without any abrupt bending at any one point. Moreover, pine wood, when alive, is quite tough, and will bear a good deal of distortion without fracture. The same reasons operate to protect our other coniferous trees of the spruce and fir tribes.

The white-oaks, although peculiar in retaining a good deal of their last year's foliage in winter, and carrying thereby a heavy load of ice on such occasions, have a prodigiously strong fibre, and, when alive, the branches possess great toughness. Any-one who has tried to break a small limb from a living white-oak tree knows that it is nearly impossible. The white-oaks of Worcester county, Mass., are famed for the hardness and toughness of their wood, which is fully twice as strong to resist fracture while green as that of the white-oaks of the western states, though probably similar to the same kind of oaks growing near the same latitude, and as near the sea in other states.

On the other hand, the maples, elms, ashes, beeches, and many other deciduous trees which abound in the district referred to by Mr. Davis, make branches that pursue an upward direction, and continue to bifurcate, as they grow upward, at small angles both with one another and with the parent stem or trunk; while their fibre lacks toughness, i.e., is easily split in most cases. When these upright branches bend downward with the load of ice, the mechanical problem is quite different from that existing in the pines and spruces: for, as the branches of these evergreens become more and more pendant, their centres of gravity, after getting below their point of origin, as they soon do, approach the trunk, and therefore exert less and less leverage the more they bend: while in the case of a beech, ash, maple, or elm tree, the centres of gravity of the upright branches depart from the vertical line of the trunk or point of bifurcation, and gain in leverage to effect fracture as they bend down, till they pass the horizontal; and then resistance to splitting is so feeble, that they often split at the fork before getting down as far as a horizontal position.

Among ornamental trees are some of peculiarly weak fibre which suffer extremely from ice breakage. Such is the Virgilia lutea, of which I have some large specimens thus mutilated, though still very beautiful trees in June. EDWD. S. PHILBRICK.

Brookline, Mass., March 1.

Habits of batrachians.

I have been unable to obtain information regarding the habits of the Amphiumidae of the United States,— Cryptobranchus or Menopoma, Amphiuma, Necturus, Siren, etc. (hellbenders, mudpuppies, etc.). Can any of the readers of *Science* tell where and when they are common, their larval habits, egg-laying habits and seasons, etc.? GEORGE BAUR.

Yale coll. museum, New Haven, Conn.

A tornado brood in Hampshire county, Mass.

I find some additional notes, made at the time, from which it appears that the storm resulting in the destruction of Northampton bridge, June 14, 1877, exhibited at first a whirl in the shape of a huge umbrella hanging from the main cloud, the convexity upward: its destructive career may therefore be interpreted as a tornado. I find, also, notes of a tornado at Westfield, July 9 of the same year. This was reported as coming down the gorge of the Westfield River, and thus confirms my view of the origin of the tornadoes I described (*Science*, Feb. 5) as having their point of departure over the Mill River branch-valley. H. W. P.

'Marvels of animal life.'

In a notice of 'Marvels of animal life,' in *Science* of Jan. 1, your reviewer says, "It will surprise some readers to see man and the Pteranodon represented on plate 31 as contemporaneous." The human figure was introduced in the cut merely to give young people some idea of the size of the animal, and was intended to have no other significance, the omission of this explanation in the text being an oversight.

C. F. HOLDER.

Pasadena, Cal., Feb. 17.

The competition of convict labor.

In reading Mr. Langerfeld's letter in *Science* of Feb. 19, one point occurs to me. He finds fault with my arithmetic. Now, I made it clear in one of the earlier articles that the competing power of convicts was in this country only about sixty per cent of what their numerical strength would seem to give them. In my letter printed in your issue of Feb. 12, all this was taken for granted, as I was unwilling to cumber your space with a repetition.

NICHOLAS MURRAY BUTLER.

New York, Feb. 25.

SCIENCE.—SUPPLEMENT.

On the freedom of contract.

FRIDAY, MARCH 5, 1886.

REGULATION OF CONTRACTS.

THE present age is fertile in economical problems, due, in the main, to the great improvements in production and distribution, and to the consequent changes in the organization of business enterprise. Among the questions that have thus arisen, and are now demanding solution, one of the most important is that of the regulation of contracts by state authority. It is held by some that the making of contracts should be free from legal control, and that the state should confine itself to enforcing the due performance of them after they are made. Others maintain that in the present condition of industry, with immense masses of capital concentrated in a single hand, or in a single board of control, the interference of the state is sometimes needed for the protection of the weaker party to the contract, or of the general public. We have witnessed in recent years an example of state interference with contracts on a great scale in the Irish land law. This measure not only released the tenants from some portion of their accumulated debts, after the manner of a bankruptcy law, but it also provided certain tribunals to fix rents for the future. No greater interference with freedom of contract has occurred in modern times, and the example thus set may have important results in the future. We Americans have not as yet any land question of this sort to deal with; but cases are constantly arising in which the question of regulating contracts appears, and the consideration of it, therefore, cannot begin too early. We bespeak our readers' attention to the accompanying essays and to the important subject of which they treat.

HOW FAR HAVE MODERN IMPROVEMENTS IN PRODUCTION AND TRANSPORTATION CHANGED THE PRINCIPLE THAT MEN SHOULD BE LEFT FREE TO MAKE THEIR OWN BARGAINS?

I.

THERE has been a time in the history of almost every civilized race when a man had a right to bargain himself into slavery, if he chose, and this right was repeatedly exercised. But such bargains were so clearly against public policy that they were done away with long before slavery as an institution was abolished.

Where two parties to a transaction do not meet on equal terms, free contract may be the surest means of destroying freedom. Freedom, as far as it exists, is the right to do as one pleases with himself or certain objects: free contract is the right to limit that right. There are many instances in which more free contract now, means less freedom forever after. Self-enslavement was an extreme case, and belongs to past history; but there are many others which involve the same principles in practical shape to-day.

For instance: common carriers try to make special contracts which shall relieve them from common-law responsibility, and put the shipper at a disadvantage in various ways. The courts refuse to enforce such contracts. The law not only assumes that the parties to the contract meant a great many things which they never thought of: it sometimes insists that they did not mean certain things which they actually said and wrote. The courts are guided by considerations of public policy in interpreting transactions, and enforcing contracts. A right of every man to make his own bargains, apart from and above such considerations, never has existed, and in a highly organized society it is hardly possible to conceive how it ever could exist.

The practical question is, Where shall we draw the line? And the point with which we are immediately concerned is this, Have there been any industrial changes which make it seem desirable to draw the line differently to-day from what we should have done half a century ago?

To this question it is safe to answer, Yes. The growth of large permanent investments under concentrated management has developed a whole system of new conditions affecting liability, discrimination, and pooling. The old laws applied to the new facts produce in many cases an effect quite contrary to that which was designed: hence the demand for new laws, and for new interpretations of existing laws.

The growth of large investments of this kind dates from about 1815. Three causes combined to

favor this growth. The steam-engine gave the large establishment its motive power; the modern transportation system widened its market; the development of the joint-stock principle gave it the chance to secure the requisite capital from a number of small investors. Under these circumstances we have seen factories displace home industry, and large factories crowd out small ones; we have seen turnpikes give place to local railroads, and local railroads consolidate into vast systems. The factory or the railroad may be owned by a large number of stockholders, but it is controlled by a small number of managers. Each factory or railroad is managed as a unit, against a large number of employees on the one hand, or a large number of shippers on the other. This seriously affects the truth of the assumptions on which the system of free contract is based.

It has been assumed, that, under a system of free contract, competition would take care of prices, and responsibility would take care of itself. But, as a matter of fact, the large concerns have managed to lessen their responsibility as their power increased; while competition has become so uncertain or spasmodic in its action as not to do the work which was expected of it. Each of these points requires detailed explanation.

In the first place, the way in which these masses of property are held tends to lessen the responsibility of the management.

When a man manages a private business of his own, he is personally liable for all the debts which may be incurred. When he puts his money into the stock of a corporation, he is liable only to a limited extent. His personal risk is greatly reduced. But this is not all. As corporations grow larger and larger, the proportion of the stockholders who can take any active part in the management is constantly reduced. The managers become a distinct body, — an inside ring, whose interests may at times diverge from the true interests of the property. This is especially the case where most of the capital has actually been furnished by bondholders, to whom the management is not even nominally responsible. Where a man is handling property of his own, he may be trusted to pursue a more conservative policy: where he is handling property of other men, to whom he feels little or no direct responsibility, his policy will often be speculative in the worst sense of the word. While the railroad inflation schemes of 1882 are fresh in our minds, there is no need of going into detailed illustrations of this fact.

As long as the chance for making money out of such abuses exceeds the chance for holding the management responsible, self-interest will furnish no cure. And these abuses are clearly fostered by unlimited freedom of contract on the part of managers. The doctrine of *ultra vires* is a sound though somewhat clumsy protest against such freedom. The English principle, rigidly forbidding the directors to have a personal interest in contracts with the corporation, is equally sound. Even the most strenuous advocates of non-interference must recognize the necessity of some such restrictions on corporate management.

There are special reasons why it is easy for a large concern to evade much of its responsibility to its employees. The matter of accidents will serve as an illustration.

Fifty years ago it was usually not hard to place the responsibility, in case of injury, in the conduct of any business. The employer worked among the men. If he gave an order which resulted in injury, it was his fault; if he allowed the machinery to become grossly defective under his own eye, it was his fault. Otherwise the fault was with the men to whom the accident occurred. To-day all this has changed. The employer no longer works among the men. He no longer gives his orders direct. He no longer has the chance to see the defects as they arise. If an order results in accident, it is easy for the employer to shift the responsibility upon a subordinate. If the machinery becomes defective, it is easy to prove that the employee had the chance to see it when the employer was not within a hundred yards of the spot. Even when the processes are dangerous, and are known to be dangerous, the employer can frequently relieve himself of all responsibility. The time when the accident occurs will usually be determined by the negligence of some employee. A momentary inadvertence puts a special strain upon the already weakened machinery. A catastrophe follows, and a number of men are injured. But the employer can show that his machinery was no worse than that of other factories; that it was the negligence of some employee that occasioned the disaster; that the men knew what risks they were running, and must take the consequences.

This illustrates the danger of unrestricted bargain. It is held that the man who accepts employment in an industry which has been dangerously managed, tacitly bargains to take the consequences. The employer is practically relieved from legal responsibility. And yet morally he is the responsible party. To a far greater degree than the employee, he has the knowledge and the power which should prevent the disaster. The law enables him to shift his responsibility upon the weaker party. It will not do to say that the employee takes his own risks. It is not a question between employer and employee alone: it is a

question in which the whole community has an interest. If a man is morally responsible for the injury to another, and we allow him to be relieved of legal responsibility, we strain the basis of public opinion on which the enforcement of law rests. This fact is being gradually recognized. The English employers' liability act of 1880 corrects some of the worst abuses of the principle of 'negligence of fellow-servant;' and a recent decision of the supreme court does much the same thing for the United States.

It is not merely against their employees that large concerns can relieve themselves of responsibility. The case of carriers' contracts has been already alluded to. Were it not for the opposition of the courts, such a concern could throw responsibility for damage upon the shipper as easily as upon the employee. In spite of all the courts can do, the carrier's position is so much stronger than that of the individual shippers, that he can often dictate his own terms in this respect.

This brings us face to face with the other element in our position, — the fact, that, in the every-day dealings between a large concern and its individual customers, free competition does not and can not readily exist.

1. As a matter of fact, it does not. The local shipper, bargaining for rates with a railroad, has no help from competition to protect him against mistakes of the manager. In an indirect way he receives some help, because it is against the interest of the railroad manager to discourage business along his route by higher rates than his competitors offer. But practically this principle is violated in thousands of instances, and competition affords no relief. Unless the manager makes his rates so high everywhere as to tempt a parallel road into the field, no amount of individual injustice will work its own cure. The local shipper does not enjoy free competition. Even if the supply of transportation facilities is more than adequate to meet the demand, the supply is monopolized, while the demand is not. The competition is all one-sided.

It is much the same way with a large factory dealing with unorganized employees, especially if the employee is so situated that he cannot readily change his residence. And it is so, to a far greater extent than we are wont to suspect, in the production and sale of manufactured goods. A few instances, like the Standard oil company, have become notorious, and have withdrawn attention from the rest; but the number of industries where a pool or division of the field has been carried out is really very large. It is rare that for a weak individual, dealing with a strong organization, competition exists in any thing but name.

2. As a matter of theory, competition cannot produce the effects which have been expected of it. It tends to keep down profits, and limit average rates; but it does not prevent disastrous fluctuations, or protect the weaker individuals. Rather, it harms them by causing discrimination in favor of the stronger and more unscrupulous. This is one respect in which the industries of to-day differ from those of a century ago. The larger the permanent investment, the less good and more harm competition can do. What was nearly right for a bank or store, is partly wrong for a factory, and almost wholly wrong for a railroad.

The expenses of a railroad (and the same sort of reasoning might be applied to a factory) are of two kinds,—fixed charges and operating expenses. Under the former head we include interest on the investment, deterioration, and the various administrative expenses which are involved in the conduct of the business as a whole. Under the latter head we include train and station service, fuel, and the various items of expense involved in doing each individual piece of business. Fixed charges, as the name implies, vary but little as the volume of business increases or diminishes: operating expenses are nearly proportional to the volume of business.

In order to attract new capital into the business, rates must be high enough to pay not merely operating expenses, but fixed charges on both old and new capital. But, when capital is once invested, it can afford to make rates hardly above the level of operating expenses rather than lose a given piece of business. This 'fighting rate' may be only one-half or one-third of a rate which would pay fixed charges. Pig iron in England in 1873 was three times as high as in 1878. Railroad rates, on the other hand, have varied as much as this within a single year.

The old theory of competition said, "Such fluctuations cannot take place, because new capital will come in when rates are above cost, and old capital will withdraw when rates are below cost." The trouble with this theory, as applied to modern industry, is twofold: 1. Where there is a great deal of fixed capital, it can only come in slowly, and only withdraw slowly; 2. More important still, the rate at which it pays to come in is very much higher than the rate at which it pays to go out. Cost of service is calculated on two distinct bases, one of which includes fixed charges, while the other does not. The former may be two or three times as high as the latter. The difference is sufficient to give the chance for a commercial crisis or for outrageous discrimination.

Competition, if it exists at all, must exist either everywhere or somewhere. In the former case

there is nothing to pay fixed charges, and it means ruin to the investors. In the latter case the points which have no competition are made to pay something toward the fixed charges, while the others do not. This is discrimination.

Wholesale discrimination, and wholesale sacrifice of interest, are both misfortunes to the community. The customers cannot endure the former; the investors cannot endure the latter; the community cannot afford to tolerate either. In each case competition is carried to the point where it encourages the unfittest rather than the fittest. Under a system of discrimination, it is the more unscrupulous man who gets the low rates. Under a system of cut-throat competition, it is the blackmailer who reaps the advantage. Capital is invested, not for the sake of its earning-power, but for the sake of speculative manipulation and fraudulent contracts.

Both these points have been to some extent recognized by the public authorities. The doctrine of the 'reserved police power of the state,' awkwardly as it has been sometimes defined, is part of the law of the land, and is unquestionably sound in principle. It is clearly recognized under this doctrine that there are many cases where competition either does not exist, or, at any rate, does not protect against abuses of industrial power, and that in such cases the state is justified in interfering. Of late, the interferences have been more and more directed against cases of discrimination as such, rather than extortion. For the protection of the investor, less has been actually established; but the events of the last five years have shown so clearly the danger of free competition of capital in the hands of irresponsible managers, that the necessity of some such protection is beginning to be quite generally admitted.

Most of the actual limitation of competition has been done without the aid of the law, and to a large extent in defiance of the law. A pooling contract, or, in fact, almost any combination of capitalists or laborers which may have the effect of limiting competition, has been placed on the same level with a gambling contract. It was void from the beginning: the law could not enforce it. Whatever may be thought of the desirableness of such combinations, there can be no doubt that this state of the law made them worse than they otherwise would have been. A combination to which the law will not lend its aid, almost necessarily pursues a short-sighted policy. The worst features of the system of combination are intensified.

That such combinations will exist, whatever our laws on the subject, has become quite obvious. That unregulated competition sometimes produces the worst results, is also obvious. Why not allow voluntary regulation of such competition within certain limits, and hold the combination responsible for abuses which may arise? An open, responsible, perhaps incorporated combination of capital or labor is in many respects better to deal with than a secret and lawless one. Such publicity would increase the power of combinations for good; while the chance for evil, whether by a 'corner' or a 'boycott,' would be greatly diminished by responsibility. There is a clearly perceptible movement of public opinion in this direction. How far it will carry us remains to be seen. In England they have gone much farther than we have, and the results seem to be good. On the continent they have gone much further than in England. As far as concerns railroad policy, it is safe to say that the continental states have adopted the principle that the only way to prevent the abuse of free competition is to recognize combination, and hold each combination responsible for what it does.

The successive points may be summed up as follows: —

1. The present century has witnessed a rapid concentration of industrial power in a few hands.

2. Where power has been thus concentrated, responsibility has been lessened; where contract is nominally free, the stronger party can shift the responsibility upon the weaker.

3. An individual dealing with a large concern cannot rely on free competition to protect him. Sometimes it does not exist, and sometimes it can not.

And the practical conclusion is, that it is a great deal more important to put the responsibility upon the shoulders of the men who have the power, than to insist upon a nominal freedom which does not correspond to the facts.

This paper is not intended as a plea for extension of government activity. Such extension is threatened from every quarter, and it involves the most serious dangers, both political and moral. To argue in favor of unrestricted freedom of contract is simply to court such danger. Allow the employer to exempt himself from responsibility, and you drive the community into a system of factory inspection. Allow the railroad to make arbitrary differences in its charges, and you furnish the most powerful argument in favor of state railroad ownership. To try to preserve freedom by chafing at the restrictions of public policy is simply suicidal.

For a nation to enjoy political liberty, it was necessary for its members to resign some of their former lawless independence: the alternative was despotism. To enjoy industrial liberty, it will be

necessary to resign the claim to industrial lawlessness: the alternative is socialism.

ARTHUR T. HADLEY.

II.

THIS is a question in speculative jurisprudence. In old times we never should have thought of debating such a question. It is, however, far from being a silly question in the times on which we have fallen. It brings out, upon the arena of debate, the major premise of a number of projects and doctrines which are now advocated; and we know that the fallacies lurk most in the assumptions of the major premise. It is also a significant fact that we are forced to discuss speculative questions where speculation has no business, just when speculation is condemned in its proper domain, and when the true uses of history are ignored by those who want to use history out of its sphere.

Status and contract, regulation and freedom, combination and competition, are the jurisprudential, the constitutional, and the economic facets of the same thing. Each couplet is complete in itself, and its parts are entirely complementary, as much so as heat and cold. Hence, if we narrow the field of contract, we shall extend that of status. We shall create new rights derived from the new status, either for all citizens or for the classes affected (e.g., the poor, debtors, employees, tenants), to which there will be no corresponding obligations; and we shall correspondingly extend the range of torts. We shall in like manner shift the adjustment of freedom and regulation now existing in our constitutional law, diminishing individual responsibility, and increasing collective responsibility, in the same degree.

What, then, are the facts upon which we are invited to enter upon such a reconstruction of the whole body of jural relations on which our society is built?

For the last three hundred years the best thought and labor of civilized men has been devoted to the effort to produce civil institutions which would guarantee to each individual the exclusive use of all his own powers for the pursuit of his own ends; i.e., happiness, as he understands it, and the equality of all before the law. Such a thing as an economically free man cannot exist, because our life on earth is held in conditions which we can modify only within narrow limits at best. The last hundred years, however, have seen a growth of our power over the harsh conditions of life by a development of the arts, which we never tire of glorifying. This development of the arts has made necessary a new and very wide organization of mankind for industrial purposes: it has produced a great demand for talent in the way of organizing and executive ability, and it has given enormous importance to capital (plant, tools, and machinery). The new organization is necessarily impersonal, automatic, and mechanical. The effect of liberty, combined with the new development of the arts, has been to surround every man in our society with a great range of new chances, from the chance of becoming a gang-boss to that of becoming a great captain of industry. Formerly a man might rise, it is true, but the chances of doing so were limited to soldiers, priests, and royal favorites. A century ago, of two weavers, one might be a better workman than the other. He could profit by his superiority only within narrow limits. To-day one might remain an operative, and the other become a great manufacturer. The modern state has, in effect, thrown open the chances of success to all, in the faith that thus the maximum of industrial power would be developed for all, and that the maximum of individual happiness would be attained for each.

In large measure the aim of fifty or a hundred years ago has been realized; but when we aim to go on and realize it still more completely, by a fuller realization of liberty to win, and security to have and hold, we are met by a reaction. We are told that liberty does not produce an ideal society, and that there are yet thousands of poor, unfortunate, and unhappy. There are no pure and unalloyed results of this so much boasted progress. If liberty has opened chances of wide improvement and advance for the better and the best, it has opened chances of deterioration for the weak and unfortunate, equally great and as terrible as the others are glorious. If society has offered chances and given security to the captains of industry, it has only created a new order of nobles — plutocrats, in fact; and the effect of the development of talent has only been to bring control of the industrial organization into the hands of a few powerful men, who can readily combine to seek selfish ends, and supplant competition by combination.

Everyone knows that there is some measure of truth in all this. It is by no means strange that it should be exaggerated and enhanced by the partial interpretations and incorrect generalizations which are sure to be made under such circumstances. How could it be expected that the world should go on at the rate of the last century, and that some should not get dizzy and frightened at the speed? How could it be expected that all should keep their heads cool, and their judgment sound, so as to interpret correctly all

the confused and perplexing phenomena of such a period of transition and confusion? We are on trial, really, as to whether we can appreciate and deserve our inheritance of institutions, rights, powers, and opportunities. The great test problem of our time is whether we can now, after overthrowing all the old privileges, hold steadily the balance of truth and justice, so as not to create new privileged classes in the new rulers of society. The impatience and derision with which the most sober appeals, and the most justifiable demands to know what is meant and whither we are being led, are met, is not re-assuring. The phrase-makers and the sentimentalists seem to have the control for the moment.

It is true that men have attached hopes of easy and universal happiness to progress which were doomed to disappointment. It is true that the new development brings new tasks and new difficulties. All development will do so to the end of time. It is true that the great plutocrats and captains of industry have now great power, and that, like all others who have ever held power, they may abuse it. It does follow, truly, that appropriate developments of our institutions will be called for to meet the new difficulties. The proper solution of all such cases must be found as they arise one by one. It is a vicious and mischievous procedure to anticipate them, to speculate about them, and to lay down broad principles in advance by which to solve them. It is as vicious in political science as casuistry is in morals.

There are three very common assertions in regard to the effects of modern improvements which I hold to be incorrect in fact.

1. It is often asserted that progress has made the poor poorer, and that it has crushed down those who are worst off to a position worse than that which they formerly occupied. This is an historical assertion, and is quite different from the other assertion with which it is often connected, that our least well-to-do classes are not ideally well off. The advance-guard of our society is far ahead of any grade of physical well-being which men have ever before enjoyed, and the distance between our advance-guard and our rear-guard is far greater than ever before; but the rear-guard is far ahead of any position which the rear-guard ever occupied before. From this statement the victims of industrial folly or vice must be excluded. At no time has any large mass of men enjoyed such command of the conditions of material welfare as is now enjoyed by the mass of men in the great civilized states. This is the only proper measure of social achievements, not any ideal. If anyone thinks that this could be gained without any alloy of incidental trouble and difficulty, he must have little experience in the observation of human affairs.

2. It is sometimes asserted that the chief result of progress is to offer more chances for gambling speculation. On the contrary, the result of the improvements in production and transportation has been to reduce the irrational element in trade and industry to rationality. There are no speculators in the United States to-day who are any bolder than Bingham and the two Morrises, and the merchants of the commercial war period, and the land speculators of old times. It is erroneously asserted that the great gains in wages of superintendence come from speculation. If that were true, they would, like all gambling gains on pure luck, ultimately average zero. The great gains of the superintendent, which are popularly called speculative, come from reducing the irrational element of luck to rationality, by investigation of facts, sagacity in judging the market, and calculation of probable results.

3. It is asserted that progress has given the captains of industry control of the labor market. Taking good and bad times together, it is impossible to say who has the control of the labor market, employer or employee, because neither of them has it. Each needs the other. As the times change, the need of one for the other may become greater, and one or the other becomes stronger in the market accordingly.

Having thus cleared the ground and got the case before us, let us attempt a more specific reply to the question proposed.

1. The great use of history is to verify and rectify our deductions by a continual reference of them to facts of observation; but a further use of history and sociology is to train the judgment to an instinct or sagacity for the estimate of the conditions under which, and the limits within which, we can take measures for an end which we judge expedient. This instinct or sagacity can be expressed in certain maxims, but the maxims are inelastic, and fail to carry the very element which is most important. The finest example of this is the maxim *laissez-faire*. For purposes of instruction, and for those who are not in the way of forming the instinct described by independent study, the maxim is of the greatest value. In any case, and for anybody, the lessons of history take form in general habits of thought, points of view, and prejudices. Now, if I read history aright, it warns us against all such rash and empirical interferences with rights, interests, and institutions, as are proposed under our question. The cases, if let alone, develop their own corrective forces, or what we thought a great danger proves to owe all its terror to our short-sighted misjudgment.

Will not the confusion solve itself? Will not our interference only intensify the confusion? The case which we are discussing stands before us as one especially calling for stern common sense. The problem has already been made far worse by rash and ill-trained speculations about it. False notions have been scattered, and impossible hopes excited, making ultimately successful and fortunate solution far more difficult.

2. If I understand the teachings of history and sociology, they show that it is not possible for any civil authority to select points at which, or narrow lines upon which, it can act upon the social organism only once, or only from time to time, and thereby impose upon the energies of the people a direction toward ends selected by the political authority, and diverging somewhat from the ends which self-interest would have led the same people to choose; self-interest being nothing but the rational procedure which leads a man to make up his mind what he wants, and to try to get it by appropriate means. If a political authority tries to do this, its subjects try to save their interests, and defeat its purposes, if they can. Hence, either the state fails of its purpose, or it has to constantly extend the scope of its control. I hold that an interference with freedom of contract would either fail of what is attempted by it, or would force a restoration of all that coercive power and comprehensive regulation in the state which it has been the work of three hundred years to break down. The socialists describe competition as the war of all upon all, — a description of it which has neither truth nor sense; but, if the course which I have just described should be taken by a modern democratic state, it would realize the tyranny of a majority over the individual, — the true socialistic tyranny, the most powerful, far-reaching, cruel, and terrific tyranny that could exist amongst men.

3. Any interference with free contract would lower the existing organization of society, because it would render insecure those manifold relations of rights and interests by which the organization of society is kept up. Society, however, keeps up its present rate of production only by virtue of all the existing organization. If the organization should be lowered, the production would be lowered. If the relations of landlord and tenant, lender and borrower, employer and employee, are rendered insecure or indefinite, and if a man who enters into those relations may jeopardize his property and his rights, or find his contracts subject to revision by outside and irresponsible interference, few persons will venture to enter into those relations. Industrial power to-day depends upon the subdivisions and combination of all these relationships. To destroy or impair them would be to lower the efficiency of capital, diminish production, impoverish us all, and, finally, either lower the population, or reduce a large part of it to distress.

If there is to be any interference with freedom of contract, it may be brought to bear either upon the making of the contract or on the interpretation and solution of it.

Generally speaking, a man does not want any interference with the formation of his contract. When two men make a contract, they do it because both of them expect to gain by it. One of them would therefore be just as much opposed to any interference with it as the other. If, however, one of the parties felt himself weak in the negotiation, and desired the intervention of some third party in his behalf, it is plain that it would be necessary to add some coercion to make the second party to the contract consent to go into it at all on the imposed terms. The usury law is a case in point. It has always been impossible to make it work successfully, because there is necessary to its successful operation a further stipulation, that anyone who has capital shall lend it to anybody who wants it at the prescribed rate. So with regard to arbitration on wages. If it should attempt to decide what wages ought to be paid, it would still be necessary to enact that the employer must employ the employee at those wages.

4. If the interference is to be exerted on the interpretation and solution of contracts, it must be general in its terms, and apply to specific anticipated groups of cases. No such legislation can be framed which will not be harsh and mischievous to a great degree. The bankruptcy law is already a case of it, and no bankruptcy law has ever been devised which does not work with great friction and great injustice on the special cases to which it is applied. The only excuse for a bankruptcy law is the otherwise insoluble nature of the case.

5. I have debated the question as if an interference with freedom of contract for adult men was possible; but the argument shows that it is not possible. If there are any difficulties already clearly defined as consequences of modern improvements, they consist in chances for combination. The correct inference is, that what is needed is to take measures, if any, to restore free competition. What we want is not less of it, but more of it. Our welfare lies in maintaining it, and warding off interferences with it. If we introduce any form of interference with it by law or by administrative intervention, we shall open the door to all sorts of corruption. There is no possible rule or principle of interference. Interference has no tests or guaranties. It must necessarily

degenerate into patronage, favoritism, sycophancy, and intrigue. It is only necessary to notice the doctrines which are affirmed and the propositions which are put forward now, by the advocates of interference, to perceive the full extent of this danger. The views and propositions to which we are treated contain all possible assumptions as to facts, and all conceivable variety of views, whims, and fads, about social affairs. Which of these schools or tendencies would get the upper hand, if our laws and institutions allowed anybody to impose his notions on his neighbor's interest? Any system of interference is necessarily arbitrary, and puts terrible power in the hands of the administrative authority, whatever it is. The value of *laissez-faire* and free competition is not that that system gives any guaranties of ideal result, or promises to fulfil any optimistic expectations, but that it throws out arbitrary action, and leaves rights and interests to be adjusted by their own collision and struggle, until they find their true resultant in the facts and conditions of the case. This is said to develop egoism in each of the parties to the struggle; but, if history teaches any thing, it is, that, under the system of interference, the regulator, whoever he is, develops his egoism at the expense of both the original parties to the struggle. A democratic or socialistic committee will surely prove no new device in that respect.

6. If it is true that we are going through a social evolution which is about to produce great transformations in society, especially as regards the distribution of political and industrial power, that is the strongest possible reason why all the people who are ready at once with their notions about what this evolution is going to produce, or ought to produce, should be most carefully prevented from meddling with it; and why, on the other hand, the evolution should be allowed to work itself out freely, that we may see what it is, or is to produce.

7. I believe that it is a complete mistake to interpret the course of things which we see as moving towards more regulation. The one supreme characteristic of our time is the thirst of the individual for material comfort and luxury. The socialists themselves bear strongest witness to it. The whole motive of their doctrine and work is that some people have not succeeded in this great pursuit of all. They demand a share, or a bigger share, in what? Nothing but the material enjoyments won by modern industry. The destructive work which is on foot is all aimed at the vested interests which secure some in enjoyment of goods, although they contribute no present work to the productive effort of society. But that very temper which leads to, or allows, that destruction of vested interests, will support all rights which are based on contribution to the productive effort. The result will be 'the survival of the fittest' in its most pitiless form. The contest which is often described as between labor and capital is really between those who have and those who have not. Plenty of laborers are to be found amongst those who have.

8. At the very time when it is proposed that our legislatures shall widen their functions, and assume more and more of the duties and reponsibilities of the old police and bureaucratic despotisms, those legislatures are showing themselves less and less fit for such functions. While the tasks grow larger and more complicated, the legislatures are less fit by their membership and organization to deal with the tasks, and every indication is that they will become still less so. They fall more and more under the dominion of plutocrats; and, the wider the functions they have, the more will it be possible for plutocrats to attain their ends by legislative corruption. Hence greater governmental functions would simply enhance the greatest evil we have to fear. Our legislatures also depart constantly more and more from the character of great councils, deliberating for the public and general good, and tend more to the character of assemblies of the representatives of local and industrial interests, who are compromising and adjusting their conflicting interests, by a method which simply consists in combining for their own advantage against those who are not on hand to fight their battle on the legislative arena. Such, in a higher degree, would be the only effect of subjecting more interests to legislative control.

It is one of the fashionable fads to suppose that there is in the community an active principle of 'distributive justice' which is available to take the place of supply and demand in regulating rights and interests. It is sufficient to point to political affairs as a test of the force, value, and availability of such a sentiment. If a jury cannot do justice in a petty criminal case without all the apparatus and procedure of the court to instruct and guide them, how can a popular and unguided sentiment be available to decide the most delicate questions of rights and interests?

There is one direction in which modern progress has already developed a need for new institutions or the modification of old ones; that is, to connect with liberty suitable and equivalent guaranties of responsibility. It may not be going beyond the limits of the subject to point out, in closing, the line upon which fruitful reform effort may be made by those who desire to work for reform.

W. G. SUMNER.

SCIENCE.

FRIDAY, MARCH 12, 1886.

COMMENT AND CRITICISM.

THE ENGLISH JOURNALS contain an abstract of an interesting paper read before the Statistical society, on Feb. 17, by Dr. W. Ogle, on "Suicides in England and Wales in relation to age, sex, season, and occupation." The proportion of suicides is 72 annually per million persons living. The suicide-rate increases rapidly until after middle life, but, in the more advanced age periods, again diminishes. The maximum rate is in the 55–65 years period, when it reaches 251 per million. The male rate is far higher than the female, with the exception of the period between 15 and 20 years of age, when the female rate is slightly in advance. The occupations in which suicide-rates are lowest are those which imply rough manual labor, carried on mostly out of doors. The occupations with the highest suicide-rates are those which are sedentary, like the learned professions, and also such as notoriously lead to intemperance. As regards farmers, suicides nearly doubled in the two years 1879–80, when agricultural distress was most acute; and simultaneously with this rise in their suicide-rate there was a corresponding rise in their registered bankruptcies. The amount of suicides varies with the seasons, forming a regular annual curve, of which the minimum is in December, and the maximum in June. The commonest method of suicide is hanging; then follow in order drowning, cutting or stabbing, poisoning, shooting. Women, however, select drowning before hanging, and poisoning before cutting or stabbing. Women take any poison indifferently: men choose painless and sure preparations. The choice of method is also affected by age, the young showing a comparative preference for drowning, poisoning, and shooting; by occupation, men preferring the instruments of their trades; by season, drowning being avoided in cold months.

MR. W. A. DUN has contributed an article on 'A local weather bureau' to *The present*, a monthly periodical published in Cincinnati. He contends that the signal service needs more observers, more stations, more frequent localized weather forecasts in less ambiguous language, and better means of diffusing their predictions; and, further, that the predictions as received from Washington should be open to amendment by competent observers in the various districts of the country, who have the advantage of seeing the local conditions, and being experienced in the peculiarities of their region. The suggestions are worthy of attention, as they come from a writer in sympathy with the success of the weather bureau, and not from one of the numerous irresponsible and ignorant critics of the service. The attempt to carry out some such plan as here suggested is to be made by the meteorological department of the Cincinnati society of natural history, that was organized last autumn. Its progress will be watched with interest.

RESTRICTIONS HAVE RECENTLY been proposed, limiting the hours of instruction in philosophy for students in the Austrian gymnasia. Most of the instruction in psychology, logic, and ethics, in German gymnasia, where it is still retained, is poor, traditional, and along the old-school ruts of Herbartism, as an inspection of the many school manuals shows. In the hands of many university professors, philosophy is degenerating in Germany. The historical methods so in vogue a decade ago, are still attractive to many students, but constantly less so; while the interminable changes rung on Kant's familiar problems have well been called the pure survival in modern form of scholasticism, till the cry is already heard from extreme neologists, that, instead of going back to Kant, he must be forgotten, if academic philosophy is ever to have a needed regeneration. Many students have become so practical that they cannot hear the word 'philosophy' without a grin, so current have become caricatures of its nature. The new scientific methods it has assumed may yield gradual amelioration of this state of affairs. 'Systems' should be left to decay, and metaphysics be seen to belong to science no less than to philosophy. One special object or result of philosophy is to make men uncertain where they once thought they knew. If young men are so taught that the great open questions whence flow all intellectual interests are closed

up, they had better know no philosophy at all; and those instructors who use their department to establish certainties in those matters where the most honest and wise men differ, are they who have brought it into its present disgrace. The same problem is sure, sooner or later, to arise in this country. Trustees and other college authorities are already beginning to ask whether, in the competition of many fresher and more vital interests, our old philosophical chairs cannot be at least reconstructed, and be made more practical in an ethical way. It is at least certain that those who intend to represent this department in our colleges in the future, must place themselves on far more scientific and ethico-practical foundation in the preliminary training they give themselves than ever before, whatever philosophic convictions they may cherish. One of the saddest illustrations of educational over-supply in our land at present, is the number of bright and able young men, well trained at home and abroad in the philosophical discipline from the slowly dissolving stand-point of the theory of knowledge, who can find no employment, on the one hand, and, on the other, the number of academic institutions now vainly seeking instructors in this department, embued with a more practical and a more scientific spirit and method.

LATE NEWS FROM SPAIN conveys definite intelligence of the recurrence of cholera, a number of fatal cases having been reported from Tarifa, in the southernmost part of the peninsula. We hear but little at present of the probability of the appearance of this dread epidemic in the United States, yet those who are acquainted with the histories of previous invasions need not be reminded that our danger is by no means past. Its duration in Europe is not limited to two or three years. The epidemic of 1829 was not extinguished till 1836, and the one of 1847 extended into the winter of 1855–56, while that of 1865 did not disappear till 1873. Already the disease has effected a landing in the western hemisphere, at Cayenne; and our immunity, so far, is doubtless due to the fact that our largest immigration has not been derived from the parts of Europe where the disease has been prevalent. In a recent report of an inspection of the Atlantic and Gulf quarantines, made under the direction of the Illinois state board of health, Dr. J. H. Rauch has given it as his conviction that the epidemic may be effectually excluded from the United States by an intelligent use of the agencies still at our command. Cholera has never yet been kept out of this country after becoming epidemic in Europe, but the possibility of excluding it is a subject that should properly engage the attention of national authority. The control of quarantine has hitherto remained entirely under state jurisdiction; but in the face of such an epidemic, threatening the whole nation, the matter of rigid quarantine is not one of local importance, and should not be relegated to local authorities.

The spread of the disease in Spain, dependent, as it is now being clearly seen, largely upon a lack of proper sanitary measures, furnishes a lesson that should not be lost. Of all the large towns in Spain, none suffered so severely as Granada. The river Genil, which passes through this city, has, a few miles above, near its confluence with the Aguas Blancas, a number of large paper-mills situated upon its banks, through which a part or all of its waters pass. A large part of Granada is dependent upon this river for its supply of water, notwithstanding the fact, that, when it reaches the city, it is manifestly impure from the contamination by the mills. The filthy rags used in the manufacture of paper at these mills were imported from the province of Valencia, where cholera had been prevalent for some time; and the first cases at Granada occurred in the districts supplied by the Genil. Possibly there is no connection between these two facts, yet it is hard to believe that they do not stand in some relation to each other, and further evidence seems almost conclusive. After Granada had itself become a source of infection, the sewerage discharged into the river carried the disease through the province of Granada, and even into the province of Cordova. Village after village along the banks became successively invaded by the dread disease, with the single exception of the town of Loja, with its twelve thousand inhabitants, where alone the people derived their drinking-water supply from different sources. The fatal effects resulting from river-pollution are apparent, not only from this, but other illustrations throughout Spain, and the warning conveyed should not go unheeded.

THAT DREADED SCOURGE of European vineyards, the Phylloxera, for which, as well as for the al-

most as injurious grapevine mildew, certainly no debt of gratitude is owed to North America, notwithstanding stringent laws, is widely extending the fields of its devastation. A correspondent of *Nature* states that it has already made its appearance in the vineyards of Cape Colony. In a few places the pest has been found in swarms, and efforts are being made to stamp it out, or at least hold it in check. Unfortunately the habits of the insect are such that it is hardly possible that the calamity threatening the grape-growing interests there can be wholly averted.

THE NAVAL OBSERVATORY.

The report of the National academy of sciences upon the naval observatory demands attention, not only from all interested in scientific affairs, but from those who desire only to see good administration. In reading the report, the first question to present itself to the mind of the candid inquirer would be, How does it happen that the national observatory of the country has remained so long under the direction of superintendents who were not astronomers, and whose profession has little direct relation to its work? A partial answer to this question, from the naval point of view, is found in letters addressed to President Barnard by the present superintendent, and published as an appendix to the report. In justice to Commodore Belknap, we must say that his arguments bear rather upon the question of the usefulness of the institution to the navy than upon that we have just suggested: but the two are so closely related, that, in answering one, he evidently intends to answer the other. It will therefore be interesting to examine his arguments, and note their bearings upon the several points at issue.

Commodore Belknap cites seven kinds of services which the observatory renders to the navy. A very slight consideration will, however, show that every one of these services could be rendered as well or far better by a national observatory under civilian authority; and, indeed, by an establishment far more modest in its outfit than even the present naval observatory, to say nothing of the projected new one. The navy-yards could get their time from the nearest railway-station with ample accuracy for business purposes. Naval ships in port could compare their chronometers with signals from a national observatory as well as the mercantile marine could, and any superiority for naval purposes which might invest a time-signal tapped over the wires by the hand of a commissioned officer might fairly be deemed counterbalanced by the skill of a civilian astronomer trained in this special business. The naval chronometers could be kept, tested, and rated at least as thoroughly at a national observatory as they are at the present naval observatory. Indeed, this is actually done at the Greenwich observatory, for all the chronometers purchased for the British navy. It could be better done at the Brooklyn navy-yard, whence most ships take their departure, by erecting and equipping a little observatory for this purpose at a cost of ten or fifteen thousand dollars, thus saving the expense, and danger to the rates of chronometers, incurred by transporting them back and forth between New York and Washington.

That officers who had never worked in an observatory till they went to take charge of one would not find their task smooth sailing, is to be expected; but we should never have anticipated such a picture of difficulties of administration as is held up by Commodore Belknap in one of his letters which appears in this report. It seems that Prof. Newcomb, in a letter to President Barnard, drew attention to the curious fact, that during the first twenty years of the existence of the observatory, when two instruments, the transit and the mural circle, were required to completely determine the position of a star, there was no concert of action between the observers with these instruments by which they should observe the same stars. Commenting on this subject, Commodore Belknap remarks, "It may be considered as an ideal state of things where two men of equal age and upon equal footing (with no military ideas of subordination) can engage in work upon two instruments, with but one clock and one chronograph between them, and have every thing go smoothly and without jealousy. The abandonment of the too ambitious programme first laid down was a matter of necessity, which it is probable no one regretted more than the superintendent."

To appreciate this picture, we have to reflect that only one of the observers needed a chronograph, and that the only use either of them had to make of the clock was to look at it. We are therefore led to infer, as the outcome of forty years' experience, that under naval discipline it is not found possible for two civilian astronomers to take their time from the same clock without friction and jealousy; that in consequence a well-

planned but too ambitious programme of work, involving a concert of action between two such observers, had to be abandoned; and that the work of forming a star-catalogue had to be postponed until it could be done with a single instrument.

We have no grounds for challenging the accuracy of this statement. Two opposite conclusions are, however, drawn from it. The view taken by the naval superintendents is, in brief, this: if line-officers of the navy, trained from youth in the art of managing men and making them work together, cannot get two men to work in the same room, observe the same stars, and look at the same clock, what would be the result of intrusting such a task to a civilian astronomer untrained in naval discipline? No organization would last a week under such a *régime*. The view of the civilian astronomer is, that all the trouble is a necessary consequence of placing the work in charge of a man who knows nothing about its execution. Between these views we leave our readers to decide for themselves.

The commodore alludes to the 'so-called scientific men of the country' who want a national observatory, in terms which do not strike us as happily chosen. He tells these misguided men that 'the navy will take no responsibility' for their observatory, in a tone which evidently implies that the threatened absence of this responsibility would impress them with a deep sense of their rashness. Whether the commodore's threat will have this effect is a question for future consideration, and we shall dismiss the subject with a single remark. It has often been said that there is hardly a graduate of the naval academy who is not ready, with great alacrity and at a moment's notice, to take charge of the coast survey, the fish commission, or any other scientific work, without any consciousness that he is undertaking a more formidable task than standing watch on the deck of a ship. We have always looked upon this statement as a humorous exaggeration; but it is hardly possible to read Commodore Belknap's utterances without a feeling that the remark may have more truth in it than we had supposed.

THE SWAMPS OF THE UNITED STATES.

THE conditions which have determined the occupation of land in the United States differ widely from those which have controlled the settlement of most other countries. In other states there have been political or geographical limits which have greatly restrained the movements of population. In this country there has been, from the beginning to the present day, an abundance of good, readily subjugable land awaiting the settler. It is evident, however, that within this decade we pass from this old condition where excellent land was to be had for the asking. Before 1890 all such fields will have been occupied. There will be no more rich frontier lands ready to welcome the immigrant: therefore the tide of immigration will be turned upon the areas which have been passed in the swift westward movement of our population. These neglected districts are of great extent and very varied nature. They consist, in part, of land which is somewhat less fertile than the best soils, but which in every other respect is fit for tillage. In larger part, however, these unoccupied districts, which constitute the land-reserves of the United States, afford soils which contain the elements required for the most profitable crops; but they are rendered infertile by an excess or a deficiency of water. In the arid but irrigable regions, and in the inundated or swamp lands, we have a very large tillable area which may be won to agriculture; and, when so won, these lands will afford resources of the utmost importance to the people.

In his report on the lands of the arid region of the United States, published in 1879, Major J. W. Powell has given an admirable account of those districts where the soils suffer from a deficiency of water, and in the preface to that report he notes the importance of the class of inundated lands; but so far, no detailed studies of the latter class of lands have been prepared. Recently, however, Major Powell has organized a division of the U. S. geological survey, which is charged with a careful inquiry into the geological history and physical conditions of the swamps and other inundated lands of the country.

A preliminary study of the field has shown the remarkable fact, that, owing to the abundance of cheap land which could be easily won to tillage, we have left untouched, in the region east of the Mississippi, districts of easily drained swamp-lands amounting to more than fifty thousand square miles of area. These lands have the same nature as those which, in England and the states of northern Europe, were drained centuries ago, and now afford the most fertile fields of those countries. The inundated lands of the seaboard region of the United States, as well as the lands of the lower Mississippi, remain in the state in which they were when first seen by men, while the similar areas in England were long ago won

to the state of the most fertile fields of that country.

Our American inundated lands are divisible into several classes, determined by the condition of their origin. Of these, the most important are the tide-water marshes, the lacustrine swamps of the glaciated district, the delta swamps of the Mississippi, and the class of wet lands or upland swamps where the marshy condition is due to the action of plants in retaining water under the surfaces of considerable districts. The formation of the sponge-like sphagnum-peat has been well described ; but it is evident that a very large part of the southern swamps of the United States are essentially climbing bogs, though the retention of the moisture is due, not, as in the north, to the mosses, but to the close-growing, flowering plants, principally to the common cane.

Preliminary studies of the great area of fresh-water marshes, extending from the mouth of the James River to the south of Albemarle Sound, show, that, in that district, this class of marshes covers an area of about four thousand square miles. Throughout this district the peaty deposit is generally thin, not usually exceeding four feet in thickness, thus permitting the roots of the trees to force their way to the subsoil below the decaying vegetable matter.

The surface of the swamp, as well as the substratum on which it rests, is generally inclined towards the natural drainage of the country to the amount of two feet to the mile. The water is retained by the dense mat of stems, roots, and decaying fragments of plants, which are so closely interlaced that the friction in the interstices prevents the speedy outflow of the rainfall.

This class of marshes can be easily and cheaply drained, and, when so improved, they afford exceedingly rich soils. Along the outer margins of these vast morasses, some hundred thousand acres have been won to culture. These lands are remarkably fertile; and I am told that they often yield fifty bushels of shelled maize to the acre, and that they endure tillage for a period of many years without fertilizing.

It seems likely that of these easily reclaimed upland morasses, resembling the Dismal Swamp, there is a total area, in the southern states, of not less than twenty-five thousand square miles. To these might be added the lands which are subject to serious inundations from rivers, which probably amount to something like eight thousand square miles.

In the northern states the area of improvable swamp-land is less extensive, but there is not a state in which they do not constitute an important part of the land-reserve which the coming generation will be glad to use. It is easy to see, that, in these inundated lands of the United States, we may find fields which will give a larger return to the husbandman than those now tilled in any state of the union ; and, furthermore, that, with the rapid increase in our population, it is none too soon for us to be considering the aspects of this portion of our domain. It is clear that the national survey can, by a proper study of these swamp-districts of the country, so determine their condition as to prepare the way for the engineer. The aim will be to ascertain their extent, the conditions determining their value for tillage, and the best method of approaching the economic questions which they present. Even where these swamps may be unprofitable for agricultural use, it may often be found that they are admirably adapted for timber-culture. The juniper (Cupressus thyoides) and the bald cypress (Taxodium disticum) are particularly suited to this form of forest-culture.

The scientific aspects of the American swamps, their relation to the changes of level of the continent, the ways in which their deposits were accumulated, cannot be considered in this place. My aim at present is to call attention to the great economic importance of this field of inquiry.

N. S. SHALER.

GEOGRAPHICAL NOTES.

Russian Lapland —Charles Rabot, during the past summer, obtained interesting details on the Kola peninsula, which lies westward from the White Sea and between it and the Arctic Ocean, in Russian Lapland. This region is very little known, and large blanks occur in the best charts. The country is rather monotonous, covered with forests, and dotted with lakes, some of which attain a large size. Imandra is a hundred and forty kilometres broad, surrounded by grand scenery, and hemmed in by two mountain-chains, which reach about three thousand feet in height, Umbdek, on the east, being a little the higher. There are no glaciers, but permanent snow exists on the peaks. After the Caucasus, this region contains the highest elevations of European Russia, and presents a desolate, barren, and impressive aspect. The lakes are very shallow : the greatest depth of Imandra does not exceed fifteen or eighteen feet, from which it shoals to a few inches. It contains many wooded islets. From this lake the explorer went to the Arctic shores, and crossed the unexplored region which extends westward from the lake. Here, where the maps indicate a flat country, he found a rugged region, bristling with mountains exceeding three thousand feet in height.

Between the White Sea and the Arctic Ocean the traveller found three series of ranges, separated by depressions covered with forests, marshes, and lakes. The Russian Lapps were well-made people, averaging over five feet in height. The people and officials everywhere gave him every assistance.

Precursors of Columbus. — Prof. Guido Cora reviews 'The precursors of Columbus' in a late number of the bulletin of the Italian geographical society. After an interesting *résumé*, he concludes that to Columbus is unquestionably due the opening of a new world to humanity as represented by civilized races; that the name of America is derived from some aboriginal word picked up by the companions of Columbus; that the precursors of Columbus, in their voyages toward America, were merely in search of wealth or prompted by a spirit of adventure, and not instigated by scientific prevision or the result of study of probabilities; that it is certain that the Scandinavians, Basques, and probably also the Irish, had reached American shores before Columbus; while to the brothers Zeno are due important charts and documents from which the previous discovery of America might be inferred.

Poliakoff's 'Journey in Sakhalin.' — A translation of Poliakoff's 'Journey in Sakhalin in 1881-82' has been made by Professor Arzruni, and published by Asher & Co. This forms a sort of monograph of the products, industries, and people of this little-known island, and is well worthy the attention of ethnologists and geographers. It contains especially rich contributions to the anthropology, mineral products, fisheries, and geography. The Ainos, who inhabit the southern portion, are exhaustively treated of. As the original documents are largely in Russian, this may be said to be for most students the first effective publication of the material.

Pilcomayo expedition to Bolivia. — Some news has been received from the latest expedition of M. Thouar, who is endeavoring to find a trade-route, *via* the Pilcomayo, between Bolivia and the Argentine states. He left Assumption Sept. 28, with an escort of twenty-eight experienced soldiers, two months' provisions, and a sufficient number of horses, mules, etc. A volunteer, Mr. Wilfrid Gilbert, accompanied the party. Major Feilberg, as mentioned by us at the time, recently ascended the river by water, finding a minimum of six feet of water in the channel up to Lambara, a point two hundred and fifty-five miles from the mouth of the Pilcomayo. Here the party was arrested by the rapids, over which there were not more than two feet of water, rendering navigation impossible, and deciding the return of the expedition. Since then an Argentine column, commanded by Captain Gomenzorro, has raided the borders of the river, killed or routed the people of the Toba tribe, living on its banks, and brought back a good deal of plunder and a few prisoners. Defeats of this kind, however, have not hitherto had much effect on the Tobas, beyond causing them to retreat temporarily into their jungles. They have avenged, as in the case of Crevaux, on other white men, the destruction visited on their villages. With this unpromising state of things, Thouar's plan of ascending the river by land, with the above-mentioned small escort, for the purpose of investigating the rapids and determining whether any improvement of the river at that point is possible, seems almost foolhardy; and it is to be regretted that the counsel of those who advised an expedition by water was not adopted.

LONDON LETTER.

THE University of Cambridge has just suffered a severe loss by the death of its librarian, Mr. Henry Bradshaw, senior fellow of King's college. The present efficiency of the university library is almost entirely due to his untiring efforts during the many years that he was at its head. His bibliographical investigations were remarkable for their accuracy, and were carried out with a truly scientific precision, while he took a special interest in that department of his duties which was connected with the literature of systematic zoölogy. Others will follow him in the post of university librarian; but it is not given to many men to be so truly mourned as Mr. Bradshaw is by the many generations of Cambridge men who knew and loved him. The terms of the university statutes require that the post shall be filled within a fortnight of its becoming vacant; and it is probable that the choice of the electors will fall upon Prof. W. Robertson Smith, the editor of the 'Encyclopaedia Britannica,' who is so well known in the subject of Old-Testament criticism. He is a fellow of Christ's college, and lord-almoner's reader in Arabic to the university.

The school of engineering at Cambridge has been making considerable progress of late years under the direction of Prof. James Stuart, M. P. for Hackney; and it is now proposed to institute a tripos examination in engineering, which should be combined to some extent with the natural sciences tripos, and would include a very considerable amount of practical work, together with some of the higher branches of mathematics.

Honor candidates who find a difficulty in mathematics need no longer be troubled with them among the 'additional subjects' of the previous

examination, which are incumbent upon all who propose to enter for a tripos, for French and German have been introduced as alternative subjects. This will be a great boon to the classical men, who have hitherto been obliged to pass a mathematical examination before they could get classical honors. In fact, the 'additional subjects' of the 'Little Go' are merely a relic of the time when candidates for honors in any subject had first of all to graduate in mathematics; and the result of this was that many of the best classical men contented themselves with ordinary degrees. Now, however, all this is changed, and their path to distinction is much easier than it used to be.

A movement of the same kind is on foot in the University of London also. At a recent meeting of convocation (to which all graduates of a certain standing have the right to belong) a committee was appointed to consider the desirability of the establishment of degrees in engineering. The first meeting of this committee is to be held to-day. It is within the knowledge of the present writer, that many well-established engineers are feeling the want of a knowledge of electricity, and hence it seems desirable, that, for any degree in engineering, a theoretical as well as practical acquaintance with electricity should be exacted from all candidates.

Probably the most complete private electric installation in the world is now to be found at the house of Sir David Salomons, Bart, at Tunbridge Wells, about thirty miles south-east of London. On several occasions lately, he has kindly invited parties of leading electricians and engineers to inspect it, and most hospitably entertained them there. The boilers, steam-engines, generating-dynamos, etc., are all in duplicate; and opening out of the room containing those, is a large and very complete series of the E. P. S. storage-batteries. Under ordinary circumstances, the engine does not run more than six or eight hours daily. In a sort of annex to the house is a magnificent private workshop, with lathes, saws, planing-machines, and all sorts of 'tools.' The whole of these are worked from two or three motors, which put in motion the overhead shafting. Many thousand pounds must have been spent upon this unique installation.

The discussion upon Prof. D. E. Hughes's paper, upon "The self-induction of an electric current in relation to the nature and form of its conductor," was concluded last night at the Society of telegraph engineers and electricians. During the three evenings devoted to it, Lord Rayleigh, Prof. George Forbes, Professor Ayrton, Dr. Hopkinson, Prof. S. P. Thompson, Dr. Fleming, Mr. Frank Pope of New York, Mr. Preece, and many others expressed their sense of the very great value, ingenuity, and originality, of Professor Hughes's researches, — an opinion which was universally re-echoed in conversation among the members generally. Great applause greeted the proposal with which Dr. Fleming (of the Edison light company) closed a very effective speech, to call the co-efficient of the unit of self-induction a 'Hughes.' Both Mr. Frank Pope and Mr. Preece, as practical telegraphists, pointed out how the experimental results now obtained by Professor Hughes provided a clear explanation of certain remarkable facts observed in telegraphy; and Mr. Preece paid a warm tribute to Professor Hughes's ingenuity by pointing out, that, whereas the speaker had had to erect a pair of lines two hundred and seventy-eight miles in length to compare the telegraphic speed of iron and copper wires, Professor Hughes's wonderfully ingenious and delicate induction-bridge had enabled him to predict the same result from experiments upon only ten inches of wire. Perhaps the most important practical feature in the paper was that self-induction in iron wire could be cured by stranding the wire; but all of the results are a remarkable illustration of science enriched by practice. W.

London, Feb. 26.

BOSTON LETTER.

THE topographical survey of Massachusetts, undertaken by the state in conjunction with the U. S. geological survey, has now been in progress for a year and a half, and about 3,250 square miles have been surveyed, or somewhat less than half the state. The parts already covered include the extreme western border of the state, embracing our highest elevations; two central sections, — one at the Connecticut, and the other around Worcester; the region about Boston; and almost the whole of the area to the south of it, lying to the east of Rhode Island, the character of which is very different from other parts of the state, hardly any parts of it being commanded by elevated positions. Hence, in surveying this, the plane-table has been laid aside, and the whole district has been mapped by traverse work; the courses of the streams, and the shore-lines of the open water spaces, being worked in by a winter party taking advantage of the ice. There is also a little completed patch in the extreme north-eastern corner of the state.

According to an estimate made by the commissioners of the survey, the cost of the work the past season has varied from about eight to nineteen dollars per square mile, and an average of a

little over ten dollars. By request of the commission, the U. S. coast survey has also aided the work by extending its triangulation over about nine hundred square miles during the past season, at a cost of a little less than two dollars a square mile, about a fourth of which has been borne by the state.

A year ago the state appropriated nine thousand dollars to enable the commissioners to take advantage of the progress of the present survey to determine by triangulation the boundary-lines of all the towns of the commonwealth. A commencement of the work was made the past season, only to discover that the estimate of the expense, based on the irregularities shown in the boundary outlines as given in the old state map, — the only possible basis for a calculation,— was far too little; probably at least double the original estimate will be required. As less than twenty-five hundred dollars have been expended, the abandonment of the scheme would be no severe financial loss; but the commissioners rightly urge its continuance under a doubled appropriation, as, when completed, it will form the best basis for a cadastral or property survey yet provided by any state in the country. This is only one of a number of ways in which our legislators are beginning to learn what it costs *not* to have a good state map, and there can be little doubt that they will be witty enough to carry the intended boundaries survey to completion.

Among the numerous partly executed plans for the improvement of Boston, its schemes of public parks hold a prominent place. The recent death of Hon. Elizur Wright has called attention anew to his proposal to establish a forest-preserve within easy reach of Boston, in the wild and little-inhabited region known as the Middlesex Fells, — a region belonging to some half-dozen municipalities, and situated on the Charlestown or northern side of Boston, not half a dozen miles from the city. On the opposite side, progress is making in the Arnold arboretum, which now forms part of the Boston park system, where definite plans, long maturing, are being put into execution. It is proposed to form two distinct collections of growing trees, — one for display; and one, less permanent, for investigation and experiment. The plan of the former contemplates, among other things, that each hardy-tree species of eastern America shall be represented by an individual planted so as to secure the maximum growth attainable here, and also by a group of from six to twenty-five individuals selected to show variations of character and habit, and planted so as to secure expression in mass rather than perfect individual development. The representation of no species will therefore depend on the life of one tree, and the natural behavior of our principal trees will also be illustrated.

The Appalachian Mountain club celebrated its decennial anniversary last Friday by a dinner at the Parker House; Prof. E. C. Pickering, whom every one recognizes as the founder of the club, presiding. As a first experiment of the kind, it proved a great success. About one hundred and twenty-five members were present, about equally divided between ladies and gentlemen, and sat to a late hour. After dinner, speeches were made by Profs. W. H. Brewer of New Haven and C. A. Young of Princeton, and by many of the home members, with letters from those who could not be present. The club may well be proud of what it has accomplished, having succeeded in obtaining a paying membership of considerably over six hundred in these ten years, and in publishing more than three volumes of *Appalachia*, — a journal which, with its two sides of mountain exploration and geographical science, holds a somewhat unique and enviable place in literature. A new number is announced to appear immediately.

It is announced that the liberality and co-operation of the Woman's education association will enable the Boston society of natural history to open its seaside laboratory at Annisquam to students, during the coming summer, from June 15 to Aug. 15, 1886. Mr. B. H. Van Vleck, an assistant in the laboratory of the society, will have charge of the instruction. Y.

Boston, March 8.

NOTES AND NEWS.

THE danger of poisoning from arsenic in wall-papers is a subject attracting considerable attention in Boston. At a public meeting the past week, called for its consideration, a draught of a bill was submitted, prohibiting the manufacture and sale of such papers when they contain more than one-fourteenth of a grain of arsenic to the square yard. A number of cases of illness from this cause were reported, as also the death of one child from the wearing of stockings colored by arsenic.

— A resolution has been introduced in the senate, empowering the superintendent of the Coast and geodetic survey to loan any instrument or instruments named in a list to any college or incorporated institution of learning in the United States, to be retained by such college or institution until the dissolution thereof, whereupon such instrument or instruments shall, if existing, be returned to said survey.

— The house committee on agriculture has reported favorably a bill to establish agricultural experiment-stations in connection with the colleges in the several states. The object and duty of these stations are to conduct original researches or verify experiments on the physiology of plants and animals; the chemical composition of useful plants; analysis of soils and water; the composition and digestibility of different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese, etc. The appropriation sought is $15,000 a year for each state, or $570,000 in all. Similar experimental stations have been conducted in Europe with great success for the last thirty years, and at the end of 1884 there were one hundred and forty-eight in existence there. There are now nine stations in this country.

— It has been decided to abandon the governmental tea-farms recently established, as they have not been productive of good results.

— The Prince of Monaco, it is reported, proposes the attempt to ascertain the course of the Gulf Stream by means of submerged floats, which will not be subjected to the influence of the winds. It is also said that the co-operation of the British authorities has been asked in the scheme.

— A recent London telegram announces that Mount Etna is in a state of eruption. It is supposed that lava is issuing from the crater, but the dense mist prevents observations. Slight shocks of earthquakes have been felt in the immediate vicinity, and stones and cinders are continually being thrown out.

— Active steps are being taken for the founding of a Hebrew university in New York City. It is proposed to make it a thoroughly orthodox sectarian institution, chiefly with the object of educating young men for the ministry. In addition to voluntary subscriptions, it has been proposed to rely upon a tax on the different Jewish congregations.

— Prof. A. C. Merriam of Columbia college, whose editions of Herodotus and the Odyssey, and more particularly his investigations in Greek archeology, have gained him a foremost place among the classical scholars of this country, has been elected director of the American school at Athens, for the year 1887–88. While in Greece, Professor Merriam will pay particular attention to archeology, especially Cyprian.

— The cost of small-pox to Tennessee is estimated by the State board of health to have been nearly one hundred and fifty thousand dollars during the past five years.

— Russian papers have lately been discussing the project of a canal between the Sea of Azov and the Caspian Sea, with speculations upon the probable effects of the higher water-level of the former. The shores of the Caspian Sea are low, and there is a question whether or not they would be inundated.

— An article by G. L. Kittredge in a late number of the *American journal of philology* describes a singular custom among the Greeks. An ancient Greek, if he murdered a man, sometimes mutilated his victim in a peculiar way, known as *μασχαλίζειν*. or arm-pitting. The extremities of the hands were cut off, strung together, and fastened under the arm-pits of the corpse by a band or girdle round the neck. There are two main theories as to the purpose. According to the one, the *μασχαλίζειν* was a part of the *ἀφοσίωσις*. The cut-off extremities were the *ἀπαρχή* of the victim, a sin-offering to the infernal gods to expiate the murder. According to the other, the mutilation of the body was supposed to effect a corresponding mutilation of the soul; so that the shade, deprived of its limbs, would be powerless to take vengeance on the criminal. It is the latter view that the writer advocates, formed on the basis of a close examination of the *loci classici*, and next by a long array of evidence from the history of culture.

— An extract from a letter recently received at the hydrographic office from the master of the Russian bark Preciosa, at New Orleans, states, that "on the 26th of January, at six A.M., the vessel being in latitude 17° 04′ north, longitude 69° 07′ west, running with all sails set, steering west, speed ten knots, wind fresh, north-east, I felt what I considered to be a strong earthshock. It threw the vessel over a good deal, and at the same time we shipped a heavy sea, although the vessel was in ballast, and the water had been smooth all the morning. It only lasted for a few seconds, and, directly after, the wind went to the south-east, and died away; afterwards it was nearly calm for the three following days."

— We would call the attention of amateur astronomers to a very convenient collection of ephemerides, etc., contained in the 'companion' to *The observatory*, for 1886. Positions for the sun, moon, and major planets, are given at suitable epochs, with ephemerides for the satellites of the planets, and in many cases for physical observations. There are also lists of double and variable stars, test objects, remarkable nebulae and clusters, etc., all made easily accessible and intelligible.

— The Transactions of the seismological society

of Japan, vol. viii. 1885, contains a long paper by Professor Milne, in which he has collected a detailed description of ten series of experiments carried on at different times from 1881 to 1884, for the purpose of investigating phenomena connected with earth vibrations. The experiments were all performed in or near the city of Tokio, and consisted in originating artificial earth vibrations, usually by dropping a heavy weight or by exploding dynamite, and then studying the circumstances of their propagation by means of the various seismographs which have been devised by himself or his co-workers in Japanese seismometry. It appears that the first effect upon a seismograph with a single index is an impulse in a normal direction; and, similarly, a bracket seismograph arranged to indicate normal motion begins its indications before a similar seismograph indicating transverse motion, implying that the normal wave travels more rapidly than the transverse. Near to an origin, the normal motion is first outwards, then inwards, and the motion inwards is greater and more rapid than the motion outwards; while, at a distance from an origin, the first motion may be inwards, and the two phases are practically of equal amplitude. Roughly speaking, the amplitude of normal motion is inversely as the distance from the origin. The laws of transverse motion are practically the same with those of normal motion, but less pronounced. Near to an origin, the amplitude of the transverse motion is less, but the period greater, than that of the normal motion. The velocity of transmission obtained varies from two hundred to six hundred feet, which is much less than the velocities obtained by Mallet and by Abbott.

— Uhler's check-list of the Hemiptera heteroptera, or true bugs, of North America, recently published, contains 1,448 species, distributed among 425 genera, or an average of 3.6 species to each genus. Classification here, as in some other branches of entomology, appears to have been carried too far, though doubtless many more species yet remain to be discovered.

— Drs. D. E. Salmon and T. B. Smith have just published (Proc. biol. soc. of Washington, vol. iii.) a remarkable discovery, made by them, of a new method of producing immunity from contagious diseases. By experimenting upon pigeons, they were able to establish an immunity from the disease known as swine-plague, by the inoculation of solutions in which the pathogenic bacteria had been cultivated, and afterwards destroyed by heat. The conclusions they reach are as follows: 1°. Immunity is the result of the exposure of the bioplasm of the animal body to the chemical products of the growth of the specific microbes which constitute the virus of contagious fevers; 2°. These particular chemical products are produced by the growth of the microbes in suitable culture-liquids in the laboratory, as well as in the liquids and tissues of the body; 3°. Immunity may be produced by introducing into the animal body such chemical products as have been produced in the laboratory.

— Professor Davidson, in a paper on the temperature of the water of Golden Gate, in Bulletin No. 4 of the California academy of sciences, states, that, from a mean of nearly ten years' observations, the lowest temperature is for the month of January, 50°.49 F.; and the highest for the month of September, 59°.68 F. The average range is thus only nine degrees, and the extreme range has only been thirteen degrees. The temperature of the air follows closely that of the water; and it is the uniformity of the latter's temperature along the Pacific coast, and its coldness, which conspire with the north-west winds of summer to cause the peculiar foggy conditions which prevail.

— In the Proceedings of the Linnean society of New South Wales, Dr. Lendenfeld reports upon a sponge destructive to oyster-culture. Large areas of oyster-beds in the Clarence River were destroyed by their attaching themselves to the shells, preventing the formation of spat. With the destruction of the beds the sponge disappeared. The latter he describes under the name Chalinula Coxii.

— Examination of the cheese, which some time ago caused the sudden and severe illness of several hundred persons in Michigan, has shown the poisonous character to be due to a peculiar crystallizable substance, or ptomaine, of an intensely cheesy odor, to which the discoverer, Dr. V. C. Vaughan, has given the name of 'Tyrotoxicon' (*Zeitschr. f. physiol. chemie*, x. 146, 1886).

— Dr. Ten Kate, the anthropologist, has been pursuing his investigations in Dutch and British Guiana, and intends to extend them into Venezuela and Florida, chiefly with reference to the Carib Indians. He has already measured, in a very detailed manner, one hundred and six individuals of the Arrowak and other tribes, wood negroes and métis.

— Major Powell has submitted to the commission investigating the question of the proposed consolidation of the various scientific bureaus his reply to the recent strictures of Professor Agassiz upon the work of the geological survey. The letters have not yet been made public, and are to be printed in connection with the testimony taken

before the committee now investigating the subject.

— The Abbe Laflamme, of the University Laval at Quebec, has lately read an essay on the physical geography of the Saguenay, before the society of geography in that city. He first describes the actual geographic form of the district, and then discusses its geological history, even from Archaean times, with special reference to the formation of the old limestones that lie in basins on the crystalline rocks as an early chapter, and to the glacial invasion as a later one. The present discharge of Lake St. John is recognized as post-glacial; the old outlet being more or less obstructed by drift, and in part occupied by Lake Kenogami. The deep gorge of the lower Saguenay is attributed to ordinary erosive action through long geological periods, and the cañon of the Colorado is called recent in comparison with it.

— The programme for the first half of the course of weekly lectures at the national museum is as follows: Saturday, March 6, Mr. William Hallock, The geysers of the Yellowstone; Friday, March 12, Prof. William Harkness, How the solar system is measured; Saturday, March 20, Prof. T. C. Mendenhall, The nature of sound: Saturday, March 27, Prof. F. W. Clarke, The chemistry of coal; Saturday, April 3, Dr. C. Hart Merriam, The migration of birds.

— The bill now before congress, providing that from and after March 4, 1892, the metric system shall be exclusively employed in the several departments of the government, was favored by the Boston society of civil engineers, at their meeting the past week.

— An account of a singular habit in the cicada is related and illustrated by J. S. Newberry in the *School of mines quarterly*. In Rahway, N.J., a house had been built and a cellar dug in an orchard some time before the appearance of a brood of cicadas. The unused cellar was opened about the time of their advent, and the bottom was found to be thickly set with mud-cones or tubes from six to eight inches high and an inch or more in diameter, each of which had been formed by the pupa of a cicada that had emerged from the earth beneath the cellar. Finding a dark chamber, and apparently desiring to work up to daylight, the cicadas had taken the moist clay and of this formed pellets, with which the tubes were built up, apparently with the purpose of bridging over the vacancy, and thus reaching the surface. The tops of all were closed; but, on breaking some of them, the pupae were seen, both in the hole in the ground and in the cone. After the cellar was opened, and light admitted, they stopped building, and made holes in the tops of the cones for exit. The author further remarks that in these facts there is evidence of the exercise of intelligence in the cicada, and a judicious adaptation of means to an end in circumstances that, it would seem, must have been without precedent in the experience of that or any preceding generation, and therefore for which no education of ancestors could have given a preparation. It is possible that the pupa of the cicada is sometimes embarrassed, in its ascent to the surface by water, by too wet or too dry sand or mud; but it is hardly possible to imagine circumstances where the construction of a tunnel would be necessary. There seems to be no adequate explanation of the phenomena that will bring them within the scope of the theory according to which all our organs and faculties are the result of formative influences progressively developed through a long line of ancestors.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Bishop's ring during solar eclipses.

THE persistent visibility of Bishop's ring — the dusky reddish ring around the sun — gives interest to the following extract from Langley's 'Report on the Mount Whitney expedition,' which recounts observations made at his camp, at an elevation of about twelve thousand feet, on Aug. 19, 1881. "The sky to-day, as always, is of the most deep violet-blue, such as we never, under any circumstances, see near the sea-level. . . . Carrying a screen in the hand between the eye and the sun, till the eye is shaded from the direct rays, it can follow this blue up to the edge of the solar disk without finding in it any loss of the deep violet or any milkiness as it approaches the limb. . . . It had been part of my object to make an effort to see the solar corona by directly cutting off the sun's light by a very distant cliff. . . . On the south of the camp was a range of cliffs running nearly east and west, and whose perpendicular wall rose from one thousand to two thousand feet. I found that I could choose a position on the north of the cliff, along whose edge the sun was moving horizontally; so that the shadow was fixed as regards the observer, and so sharp, that, though I must have been over a quarter of a mile from the portion of the cliff casting it, I could, without moving my place, and by only a slight motion of the head, put the eye in or out of view of the sun's north limb. The rocks were, in these circumstances, lined with a brilliant silver edge, due to diffraction. This I had anticipated, but now I saw, what could not be seen by screening the sun with a near object, that the sky really did not maintain the same violet-blue up to the sun, but that a fine coma was seen about it of about 4° diameter, nearly uniform, though it was sensibly brighter through the diameter of $1\frac{1}{2}°$. Upon bringing to bear upon it an excellent portable telescope, magnifying about thirty times, I found it was composed of motes in the sunbeam, be-

tween the diffracting edge and the observer's eye" (Signal service, professional paper, xv. p. 41).

So explicit a description as this from a well-practised observer confirms the testimony of European specialists in sky colors, and leaves no question whatever that Bishop's ring did not then encircle the sun. And yet, in the summer of 1884, it was so strongly colored as to attract attention from the guides in the Alps, and to call for special description from more scientific mountain climbers. It was generally visible on clear days in the winter of 1884–85, and on many favorable occasions through the following summer. During this winter, it has seemed to me to be generally less distinct than a year ago; but the most brilliant display that I ever recorded was shortly after noon on the 2d of last November, when the sun was hidden by a rather heavy sheet of cirro-stratus cloud, while the western sky was clear. The glaring and brassy central area was then enclosed by a ring of strong reddish-gold color, fifteen to twenty degrees from the sun; next came the delicate rosy or purplish pink, and at last the ordinary blue of the sky. The colors were wonderfully vivid.

Many if not most observers of the ring attribute it to diffraction on particles of some sort derived from the eruption of Krakatoa; and, while this hypothesis has much to recommend it, it cannot be denied that the continued visibility of the ring puts a severe strain on it. It is not to be wondered at that the cosmic origin of the colors has its advocates, and hence a method of determining the altitude at which the diffracting particles float is of especial value.

Dr. Zenker of Berlin has a pertinent article on the question in a recent number of the *Meteorologische zeitschrift* (Berlin, ii. 1885, 400–406), in which he discusses the effect that the altitude of the diffracting layer of dust will have on the visibility of the ring during total solar eclipses. And as a total solar eclipse, visible in South America and on the Lesser Antilles, will occur about half-past seven in the morning of the 29th of next August, we would request especial attention to this matter from astronomers who may go down to observe it. Dr. Zenker gives directions for observations on or near the central line of the moon's shadow, and shows how they may lead to the desired determination: for it is evident, that, if the diffracting dust were all within a few miles of the earth's surface, the colors of the ring would fade away in a few seconds after the disappearance of the sun; while, if the dust lie far outside of the atmosphere, some portion of the ring might remain visible during the whole eclipse. This question will deserve a share of the watchfulness generally given to the solar corona and infra-mercurial planets. W. M. D.

A trap-door spider at work.

A trap door spider, Cteniza Californica, which came from California in September, was put in a box with earth, and soon made a nest with a perfect door. She was found one morning occupying a hole three-quarters of an inch in diameter and deep enough to completely hide her, around which the ground had been cleared and smoothed, so that it was somewhat lower than the general level. Unfortunately, as this part of the work was done during the night, she accomplished it unobserved. She probably cleared the ground, however, as she had done on a former occasion, when she was seen to walk slowly sideways, with all the feet on one side held together, turning slightly at the same time, and sweeping all rubbish and coarser bits of earth before her. In digging the hole, she threw the earth to a distance, as was shown by numerous little irregular lumps of earth scattered over some moss at the farther side of the box. Later the spider was seen to dispose of more in the same manner, but it was done so quickly that the exact motion could not be distinguished.

During the day she busied herself in the burrow, apparently treading against the sides, in order to make a compact wall. At night she rested, and nothing more was done until the following evening, when she commenced to build a straight ridge or rim of earth at one side of the hole. She brought up as much earth as could be carried under the mandibles, and placed it on top of this rim. When it had been secured by several strokes of the fangs, the spider turned, and rubbed the spinnerets over the spot, and afterwards all along the edge. The spinnerets were applied directly to the surface, and were used not only to produce the silk, but also to smooth and model the edge.

This process was repeated until the rim was about a quarter of an inch in height, when the spider left it, and commenced a similar one on the opposite edge of the hole. Here she worked, as before, until she had made a ridge about half as high as the other, when she returned to the first, and during the next hour added to them both alternately. At the end of that time, she brought up the first load of earth which was not used in building, and deposited it as far away as she could reach, without leaving the burrow. As she withdrew, she turned, and attached a line of web to the edge of the second rim, by which it was pulled over the opening after she had disappeared from sight. Henceforth it was necessary to lift and turn back this rim (or flap, as it might now be called, to distinguish it from the true door) whenever she came up, unless, as sometimes happened, she had neglected to pull it down.

In the mean time, the first rim, which was to become the true door, had been gradually enlarged; but another hour elapsed before any attempt was made to pull it down. The spider then fastened a line to the upper edge, by which, after a long and steady pull from below, the structure was dragged over the opening, which it only half covered. It was immediately raised, and carefully re-adjusted in an upright position. After another half-hour, devoted to adding more earth to the two rims alternately, the first was again drawn down; but, being still too small, it was once more returned to the old position, and the work of enlargement continued. As nothing but persistence in this course seemed necessary to complete the door, the spider was allowed to work the rest of the night without supervision.

In the morning the spider had vanished. The entrance of the nest was closed, and the depression around it filled, so that its position was perfectly concealed. Naturally, it was supposed that the door was finished; but the next night proved this conclusion to be erroneous. When the spider was visited at three A.M., the door covered only three-quarters of the opening, and she was still employed in adding earth to the edge. During the day the entrance had evidently been closed by the true door and the flap, used together as a double or folding door, one side being much larger than the other. The flap, no longer

needed as a cover, was now turned back and pushed away, the opening thereby being considerably enlarged. More earth was subsequently placed over and around it, until it was completely hidden, and rendered useless. Before morning the true door had attained the necessary size, and the lining had been added to it; but the lining of the burrow was not entirely completed until some days later.

A piece cut from this door showed it to be a layer of earth with a single lining; while an old nest which came with the spider, and which she presumably made, was provided with a door having nine linings, each of the eight lower ones enclosing a rim of earth, by which the door had been enlarged.

MARY T. PALMER.

The destruction of birds.

In view of what has already been said regarding the manifold ways in which our wild birds are being effectually diminished, something more should be added in reference to a practice which has long prevailed in the southern tier of states, including Maryland. I refer to the systematic shooting of thousands of song-birds in spring and fall to satisfy a market demand. In the city of Baltimore alone the destruction of robins forms a periodic business of no little profit or extent. A visit to any of the large markets at the seasons specified, where they are a constant feature of the game-stalls, will verify this statement. Rice-birds (bobolinks, as we know them farther north), golden-winged woodpeckers, red-winged starlings, and cedar-birds (the last chiefly in winter) share a like fate.

Our complaint is directed against the destruction, for purposes of food, of one and all these species, but especially the robin. It may be legitimate to destroy the rice-bird and starling at the time and place of their devastation, but this does not sanction their slaughter in districts where rice does not grow, and the species are beneficial to crops. If practical ornithologists are not wholly in the wrong, it is neither wise nor legitimate to destroy the robin under any circumstances. The robin nests familiarly in and about gardens and orchards in large numbers when unmolested, rearing two and sometimes three broods, of four or five young each, in the season; and although he makes raids oftentimes into the strawberries, cherries, and other small fruits, it is a cheap toll for the incalculable services which he has previously rendered. Instead, however, of being protected by laws generally prevalent, they are but partially protected during their breeding-season in the north, to be killed on the spring and fall migrations.

Notwithstanding the great productiveness of a species, its numbers must be very materially diminished by the thousands, and probably tens of thousands, annually shot down for the market. It should also be remembered that the destruction of these birds in spring is particularly fatal, since with each pair thus killed we kill the possible young of the same year.

The human and brute enemies of the birds have been amply alluded to, but I have seen no reference to the trade in skins and eggs which has rapidly grown up in the past few years. In obscure corners of most cities of considerable size, persons may be found who deal in birds' skins and eggs, old coins, postage-stamps, and various other specialties, conducting a largely juvenile trade through the post. Their bulletins are now sown broadcast, especially among the boys' boarding-schools of the country. They offer tempting exchanges, premiums in eggs to the largest buyer, and give the price of eggs singly or in 'sets.' In most cases there is no identification, no date or locality given, so that the scientific value is usually lost. With such educating influences as these, how can we expect the thoughtless small boy, and better class of older boys at schools, to regard egg-nesting as any thing more than harmless employment, to be carried on as extensively as that of stamp-collecting, only with much less method? In framing laws to protect the birds, would it not be well to prohibit the sale of their eggs and skins for all such amateur and pseudo-scientific purposes?

Furthermore, with all these human and brute enemies with which our native birds have to contend, what possible excuse can be found for adding a still more deadly and effectual agent, — the business-like slaughter of useful species for food? If, indeed, the game-market was understocked, other birds might be had which are not to be commended as highly for either song or utility.

People who encourage this kind of traffic, in respect to the robin at least, are either thoughtlessly or wilfully robbing our lawns and orchards of one of its heartiest and most cheerful songsters, and agriculture of an indispensable friend and ally. F. H. H.

Baltimore, March 1.

In a recent number of the Indianapolis *Times* there appeared an article on bird destruction, containing the following extracts given by a well-known taxidermist of that city. They will not only serve as additional evidence of the destruction of birds for personal adornment, but also bring into notice, in this regard, a portion of our country which has not yet been mentioned, and will give the evidence of one who should be posted concerning that which he tells.

"It is a very inexpensive and simple thing to mount birds for millinery purposes, and the number who can engage in it is so large that no county in the state is free from the ornithological murderer. If the present rate of destruction is continued, which is equivalent to saying that if the fashion in millinery does not change, the state will be depopulated of its birds in five years. I have lately spent whole days in the woods without seeing a bird, except the unspeakable sparrow. Last year there were shipped from this city 5,000 bird-skins collected from the Ohio valley, chiefly from Indiana. Now, suppose that half of these birds were females: they would lay, on an average, five eggs each in a season, — a total of 12,500 eggs. Of these, 10.000 probably would hatch. Added to the 5,000 birds killed, here is represented a yearly destruction of 15,000 birds, — a sacrifice to fashion.

"It is important to note that this represents only the slaughter of the fashionable birds. Styles change. A year ago blackbirds for women's hats were in great demand, and thousands of them were killed. Now there is no market for blackbirds. Each of the 5,000 birds sent out of the state during the year 1885 was in style; that is, was either a jay, yellow-hammer, cedar-bird, or an owl. These birds are shot and skinned, and the skins allowed to dry before shipment. One man to whom I sent birds this week shipped 75,000 skins of American birds to France, and each year he duplicates this shipment. But the most of the American birds are sold at home. They are sent to the Long Island factories, where the skins

are steamed until pliable, when they are dressed and colored. Often the small, cheap birds are cut up, and the parts patched together in imitation of some pretentious songster. The dyeing is a secret process; and the birds are so manipulated, that often a Hoosier jay is palmed off as the rarest warbler of the tropics. This year, owls promise to become popular west. East they are already worn by the leaders of fashion. You may look for them upon the streets here soon.

"The profits of this business are very large. The Indianapolis collectors pay from seven to twenty-five cents each for the skins of jays and yellow-hammers, and from twenty-five cents to a dollar for owls. An expert skinner can prepare from fifteen to twenty-five an hour; and, if birds are easily found, he easily, therefore, makes money at the business. Prepared for the milliners, the birds (exclusive of owls) cost, on an average, from twenty-five to forty cents: they are sold to milliners at from a dollar to a dollar and a half, and the milliners retail them at two dollars and three dollars and a half. At the factories cheap labor is employed. Girls at two dollars and three dollars a week are competent to do all that is required in preparing the birds for use."

There are some statements in the above which I doubt; but, having no statistics to the contrary at hand, I have given them without comment.

The law of Indiana for the protection of its song-birds is farcical in its language, and is rarely enforced. It enumerates the species which are intended to be protected; but so many English birds are included, that one is forced to smile at the very thought of it.

AMOS W. BUTLER.

Brookville, Ind., March 1.

A recent ice-storm.

I think that the answer given by Mr. Philbrick (*Science*, vii. 220), concerning the injury done to trees during the ice-storm of Feb. 11-13, is hardly sufficient to account for the facts. So far as I have been able to learn, the damage was most severe in localities along the coast, north of Boston. In this immediate vicinity the mutilation was excessive. The poplars suffered by far the most, and the elms sustained nearly as great injury, and after them would come the red-oaks, pitch-pines, maples, and white-pines. The birches were little affected, and the apples and horse-chestnuts not at all. In some cases the poplar trunks were left nearly bare. The uppermost limbs of the elms sustained greater injury than those lower down, as Mr. Davis indicated. I attribute that mainly to their position. They caught and held so much of the rain, as it fell, that the accumulation of ice was much less on the branches beneath. My observations have not shown much splitting at the point of bifurcation. A careful examination of an extensive area has shown that most of the broken limbs of the elms were twisted off, with splintering of the wood for several inches, and only occasionally one was found which had been broken off squarely. It seems clear that this result was brought about by a want of symmetry in the horizontal subdivisions of the branches. When such branches were well loaded with ice, gravity not only bent them downwards, but also produced a considerable torsional effect at a point usually quite near their union with the trunk. The apples and the horse-chestnuts seem to have escaped by reason of the fewness of their small limbs.

L. A. LEE.

Bowdoin college, Brunswick, Me., March 6.

Apropos to Pteranodon and Homo.

Professor Holder's explanation that the human figure was simply put with Pteranodon for the sake of comparison of size, reminds me that some years ago I got from the cretaceous deposit of my neighborhood enough fossil material to diagnose a new species of reptile, which, although with powerful paddles, was almost pythonic in structure, and warranted the belief that the animal was hardly less than twenty-five feet long. As an Irish digger had struck upon the relics, and the too general habit is to destroy rather than save these finds, I succeeded in enthusing the laborers by drawing a restoration of this 'sea-serpent,' to their amazement. This the boss digger had framed and suspended in his cottage. To my sorrow, the thing made me famous, for it became so much talked about that reporters came from the great city. A pictorial journal sent an artist, who borrowed my crude sketch, and elaborated it under his own conceptions. Judge of my surprise when, with full credit to my name, the said journal appeared with an account of the resurrected ancient sea-serpent, and an engraving of the same, sporting in the ocean, and in the distance a three-masted ship in full sail! As in Professor Holder's case, there was no explanation given that the ship "was introduced in the cut to give people some idea of the size of the animal."

SAMUEL LOCKWOOD.

Freehold, N.J., March 5.

Is the dodo an extinct bird?

Has the guardianship of the 'mysteries of theosophy,' or his concern for the social organism of the world, lest they escape him (see Washington *Weekly star*, Nov. 20, 1885), so far rendered my aged friend, Dr. Coues, insensible to the progress of American ornithology, or current ornithological literature, as to have him overlook the fact, that, twenty days previous to my propounding the above question in *Science*, I had said in the *Century magazine*, "Of all the birds extirpated within the last few centuries, none can claim an equal share of interest with the famous dodo" (January, 1886)?

Since I published my opinion in the *Century*, many, many people — not naturalists, but those who take interest in such things — have asked me whether science was absolutely certain of the extinction of the dodo, as many quite recent popular works upon natural history have it that it may still be found in Madagascar. It was for these estimable people that I asked the question in *Science*; and fortunate indeed are they, that it has been answered for them by one of the leading ornithologists of this country, and in whose opinion, upon this point at least, I have most certainly always concurred.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Feb. 25.

Chinook winds.

Warm west winds answering to the 'Chinook' winds occur as far south as southern Colorado, though I have seldom heard the name 'Chinook' applied to them in this region. They are here often called Pacific winds, also 'snow-eaters' and 'zephyrs.' They are the most violent winds we have at this place, as we are sheltered from the northers.

G. H. STONE.

Colorado Springs.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 12, 1886.

THE ROCKY MOUNTAINS AS SEEN FROM THE CANADIAN PACIFIC RAILWAY.

THE foot-hills of the Canadian Rockies are not like those of the south, — huge piles of sandstones, bristling with 'monuments,' and hirsute with sparse forest. After a few smooth, grassy benches and rounded hills, here come precipitous ranges of real mountains, scarcely less imposing than those of the central mass. Trees among the outer benches are rare. You see some willows, a hemlock, and the stubbed Pinus albicollis, which is not good as timber. Near Calgary the first of the magnificent Douglas spruces present themselves, — those gigantic and valuable timber-trees, for which the north-west coast is famous. They are of small size here, and stand in little clumps in the ravines.

The Rocky Mountains at this point have trended so far westward, that here they are overtaken only in the meridian of Salt Lake. The first line of heights is a rank of bluffs with almost vertical faces, each ledge marked by well-kept snow, which stretches away northward in orderly array. This is the Palliser range. The most prominent point of it is a forward-set peak visible from a wide radius of plains. In shape it is like a pretty tall stump, or the lower half of a lighthouse, and is called the Devil's Head; but the Indians, with better discernment, say it is the Devil's *neck*, and have a story about the disappearance of the head it once sustained. Behind the Palliser is the slaty Sawback range, from beyond which comes the Bow River, through deep cuttings.

In these foot-hills lives a small Indian tribe, of Dakotan stock, termed Stonies, who are fine-looking fellows and good hunters. They came there within a generation or two, and never go out on the plains except in war-raids against the Crees or the half-breeds, to whom they have given much trouble. The Hudson's Bay company set up its southernmost trading-post among them a few years ago, called the Old Bow Fort; and close by they now live on a reservation, the station for which is Morleyville.

Though the mountains here seem grand enough, having a sublimity not easily equalled among any of the loftier ranges southward, yet they must be spoken of as 'depressed' north of the boundary, since the tallest peaks do not much exceed 11,000 feet above the sea, and none of the passes are over half that. There are several fine passes over the first range, between the parallels of 49° and 53°. The southern one is Kootenay, much used formerly by the Indians, then Howse's, then that where the Kananaskas heads, then the one taken by the Canadian Pacific railway up the Bow and across to the valley of the Kicking Horse, and lastly the Yellow-head, or Leather pass under latitude 53°. Many of the principal peaks in this range were long ago named Balfour, Forbes, Hooker, and Brown, by the lamented botanist Douglas, after English men of science.

The breadth of the Rocky Mountain system (six hundred miles) in the middle United States is narrowed northward, until in Canada it consists of three compact serrations. The easternmost bounds the plains, and stretches from the sources of the Missouri to those of the Peace and the Yukon. Its eastern face presents a bold front; but its western flank is more broken up, and, not far from the boundary line, gives source in two 'mother-lakes' to the mighty Columbia, which thence flows northward in a powerful stream until it has passed the fifty-second parallel, nearly two hundred miles north-west of its starting-point. Then the mountains upon its left break down; and the Columbia, turning sharply around their head, moves straight southward on its course to the sea. Stretching north and south between Kootenay lakes and the great bending of the Columbia, stands the magnificent second range of mountains, — the Selkirks.

The course of the Columbia after it has turned southward around the head of the Selkirks is beset by lofty walls as before, for west of its banks rises a third chain, called the Gold range, whose farther slopes feed the Fraser and Okinakane. Thus three unexplored, lofty, and glacial ranges of mountains, and two first-class river-crossings, opposed themselves to the engineers of this railway when the northern route was abandoned and the present line accepted.

The profile of the Rockies seen at the eastern entrance is extremely irregular. There is no stately line of granite domes, nor bristling quartzite peaks, nor symmetrical volcanic cones: the sky rests upon a jagged wall, every elevation having some angular and abrupt form quite unlike its neighbor.

All this grandeur of outline, which gives a tenfold savage aspect, is intensified by the excess

of snow and ice borne winter and summer upon their naked heads, — the most striking fact in their scenery, a description of which cannot be attempted here.

The Bow River, at the point where it breaks through its 'gates,' is a swift, deep stream of pea-green water. We follow it for several miles through a low forest, which occupies a large valley parallel with the main range, and between it and an outlying one, which is somewhat analogous to the parks of Colorado. Near the southern end of this valley is the station Banff, — the locality of a huge sulphur-spring. This occupies a pit which has a chimney-like entrance, and broadens below into a chamber of considerable size. In the bottom of this boils up a powerful spring strongly impregnated with sulphur, and almost too hot for bathing. The interior of the cavity abounds in masses of crystals, splinter-like, brittle, translucent amber in color, and extremely beautiful, which, fortunately, are carefully protected by the owner. That the spring was formerly more copious, is shown by the oven-shaped tank it has built up more than forty feet above the present surface of the water.

Just beyond the impressive berg named Castle Mountain, which, like most of its fellows, has as many curious forms as you can find changed points of view, in the valley of the Bow River, the traveller gets sight of the first of the great glaciers which are a distinguishing feature of the scenery in the Rocky Mountains of British Columbia. It is a broad, crescent-shaped river of ice, the farther part of which is concealed behind the lofty yellow cliffs hemming it in. You seem to be almost on a level with it, and near at hand; but it is a dozen or more miles away, and fully fifteen hundred feet above you.

The forest is not noteworthy until the top of the pass (altitude about five thousand feet) is reached, when the eye gazes across miles of magnificent evergreens, filling the great depression through which the young Kicking Horse rushes from cataract to cataract, down to the westward. The Cathedral and Mount Stephen represent the supreme heights of the continental divide at this point. They are magnificent mountains, and surrounded by scores like them, unspeakably precipitous, rugged, and noble. On every side, as you make your way along, stand great cliffs, bearing prodigious weights of clear ice or almost equally solid and glittering masses of snow. In spite of this ruggedness, the gradient adopted by the railway is surprisingly low, and trains will be able to run at great speed; a schedule allowing only seventy-two hours between Montreal and the Pacific going into operation next May.

It is rather farther down from the summit on the western side than on the eastern. The exit is made through a narrow cañon, picturesquely filled by the turbulent stream; and beyond, with the grandest surprise, you emerge upon the valley of the Columbia, and are face to face with the long, splendid range of the Selkirks.

Crossing the Columbia on a fine truss-bridge, the railway runs down its margin, close under the steep, wooded foot-hills of the Selkirks. Several miles below, it turns into the narrow gateway through which the Beaver finds a straitened exit (like all the streams of this region), and ascends its gorges by ingenious engineering to the summit of the range, thirty-four miles (by rail) west of the Donald crossing, and 4,350 feet above the sea.

The principal difficulty in construction, along this part of the line, was occasioned by the many torrents which come down the very steep mountain-side, often in splendid cascades. To span these fierce torrents by bridges or culverts which should not fail, required great skill and liberal expenditure.

Among these bridges is the loftiest wooden structure of its kind in the world. It crosses Stony Creek, — a noisy rill at the bottom of a V-shaped channel cut deeply into the soft rock of the hillside; and the track is no less than 295 feet above the water. This bridge is supported upon two towers of wooden crib-work, erected upon masonry the foundations of which are solid rock 75 feet below the surface. This bridge is about 750 feet long, cost $250,000, and was built in a very short time. It is exceeded in height by only one railway-bridge in the world, — the iron one lately put up at Kinzua, Penn.

The approach to the summit is through a narrow passage between enormous precipices, down one of which pitches a waterfall several hundred feet in unbroken height, white and dusty like snow; and at the summit the glacier of which it is the outlet comes into view.

This glacier has an area of several miles, and its head cannot be seen from the pass. It is wedge-shaped, and in August was so dusty white, where the surface had been honey-combed by the sun, or powdered by the frequent storms, that it was not easy to say where it ceased and the inclined snowbanks lying under the shelter of the huge black combing began. Streaks, patches, and marbling of vivid blue (or, in some lights, green) could always be detected, however, where the solid ice was exposed; and the whole picture was irresistibly attractive. The foot of this glacier is approximately 7,350 feet above the sea, and is overlooked by Carroll's and two or three neighboring peaks, towering three thousand feet higher.

A little to the westward are other smaller and more easily accessible ice-masses, which plainly show a recent retreat; and two miles west of the summit one comes into view of the greatest of the visible Selkirk glaciers. It is overlooked by the stately monolith of Syndicate Peak, and the ice comes curving down to within a mile of the railway, feeding a copious stream. It is only about a thousand feet above the level of the rails; and, when a trail has been cut through the thickets in the ravine, it will be very easily reached, though one should no more attempt to go upon it without proper ice-creepers, ropes, etc., than he would in the Swiss Alps. I predict that the Agassiz glacier, if I may so name it, will be as famous an object of adventurous pilgrimage in a few years as any in Europe. ERNEST INGERSOLL.

THE ORIGIN OF HUMAN RACES AND TYPES.

ONE of the most inexplicable subjects in the evolution of man has been his racial persistency. The teachings of Agassiz are yet familiar, and the thorough and abundant testimony of Morton, Nott, and Gliddon has demonstrated the permanency of the great races of mankind. The peculiar physiognomy of the Jew stands out as clearly in the early Egyptian records as at the present day. Food, climate, the most diverse environmental conditions, all appear to cause but little modification in racial type. The evidence from his earliest known periods of existence throws but little light upon his immediate origin, and the opponents of evolution have long found great satisfaction in the few proofs of lower affinity that his fossil remains present. Certainly there must have been factors in his earliest development that we have not yet taken into account. When and where did the African, the Caucasian, the Malayan races first become fixed, and why have the causes that long ago led to their differentiation ceased to be active? An answer to this question, deserving consideration, has lately been attempted by Moritz Wagner (*Kosmos*, 1886, p. 23).

It has long been recognized that one of the strongest factors in the artificial production of new varieties is in-and-in breeding, — the repeated crossing, within narrow limits, of the progeny of related parents. It is rarely in any other way that the impression of peculiarities can be combined and not antagonized in the offspring. All breeders or growers are aware that the organism, be it vegetable or animal, acquires with every such repetition greater plasticity and capability of change, and that it can arrive at a considerable degree of differentiation only when free crossing is hindered or prevented for a sufficient length of time for these variations to become fixed, and not dissipated. In nature, strong proof of the same law is afforded by the faunal and floral peculiarities of regions isolated by natural barriers. The Galapagos and the Hawaiian islands, notwithstanding the uniformity of climates and general conditions, show striking diversities in animal and plant life among themselves, — the result of crossing among nearly related forms. Isolation, from whatever cause it may be due, throughout all animal and vegetable life, brings almost inevitably variation, due to the limitation of crossing, and the consequent fixation of characters.

But, in both of these respects, man has, in all his known history, been strikingly at variance with all other members of both the animal and vegetable kingdoms. In him alone, among all living creatures, exists the instinctive aversion to crossing between near blood-relations, — an aversion that predominates in every grade of civilization, from the cultivated races to the Eskimo, Hottentot, or Australian. Indeed, among the lowest tribes, the aversion is often strongest, and incest not unfrequently is punished by death. Most assuredly, man will not form an exception to a law so potent for change among other animals; and we see, in this custom of marriage between those unrelated, the most important factor in the production of varieties removed, and we can understand the difficulty of the formation of new races. The very acceptance of man's origin recognizes the certainty that some time in his development this instinct has been acquired. In the earliest period it did not exist, and he was then subject to the same laws of variation as the ape and the dog. It was to this period that the chief divisions of mankind evidently date.

Every thing goes to indicate that man's origin extends back far into the pliocene age; and evidently in his early stages he differed little, in his habits, from wild animals of the forest. Without clothes and habitation, he depended upon the free gifts of nature for food and shelter, without family instincts, and, what seems to be a necessary concomitant, without any sexual aversions whatever. With the great climatic changes of the glacial period, all this was changed. The struggle for existence became bitter: sustenance, shelter, and clothes had then to be acquired by the exercise of brain and hand. Migrations to the most favored and isolated locations were the inevitable result, and the necessity of protection of offspring became the contingency of existence. Family life took the place of more brutal instincts,

and the child remained longer dependent upon the parent. But with the constant association of near relatives an aversion was acquired to close intermarriage, resulting in the custom, or rather instinct, that now characterizes all classes of mankind. The chief factor of change thus ceased its operation, but the formation of races had already occurred.

Thus the author would account for those primitive and wide divergences that must once have taken place. With his development and acquisition of language, man became the most cosmopolitan of animals; tendency to further divergence was checked, and is now rather toward homogeneity. Anthropologists are fast recognizing the futility of separating tribes and classes by cranial classification. Very great variations are found between dolichocephalic and brachycephalic types among all civilized or uncivilized races. The pure Germanic race of the blond type is disappearing, as Virchow has shown, and greater racial uniformity is becoming apparent. The larger part of the German people is a mixture between the light-skinned indigenous race and the dark-skinned Indo-European races. Free crossing prevents the further formation of striking changes; but, with the development of civilization, a new and subordinate factor is taking, in a measure, its place, — that of national and social caste, which tends to the formation of minor variations. The peasant and the noble, the Jew, the German, Frenchman, or Englishman, — all are differentiated by very tangible characters, the result of partially restricted crossing, from social causes. Thus in man's history we see the unrestricted crossing of bestiality, fruitful in change; the acquired humane instincts averse to pairing between blood-relations, and eager for remote and strange mates; and, finally, the prejudices of social and political castes that lead to the formation of minor variations.

AN OLD-FASHIONED BOOK.

THIS volume seems to be in its principal features an abridged translation of Weber's 'Lehrbuch der weltgeschichte,' to which, indeed, Dr. Fisher acknowledges his great indebtedness, especially as to ancient and mediaeval history. As to the need of some such book as the one under review, there can be no question. Teachers still, even in many of our best colleges, use the old mechanical method of teaching history. We call it the mechanical method with no intention of discrediting it; for there is no doubt but that, in the case of the great majority of our history teachers, the safest way is to put a good book into the hands of the student, and make him commit to memory so many pages a week. To be sure, he forgets most of his facts as soon as possible after the examination. But, on the other hand, if the book is a good one, he has learned very few things which will have to be carefully unlearned in after-life. The best example that occurs to us, of the working of this system, is with regard to the teaching of botany in one of our smaller sectarian colleges not so very many years ago. The text-book was large, and well supplied with poor pictures. The class came in regularly: they could not be absent without excuse. As soon as the man in charge had satisfied himself that all were present, he said to N. or M., 'Proceed.' N. or M. proceeded to recite from memory the opening paragraph of the day's lesson. When the man in charge thought he had recited enough, he ordered another boy to 'proceed.' Then came reviews and second reviews. At the end of the term or year the boys knew the book by heart. As they had never analyzed a flower, or applied the knowledge thus gained in any way, their botanical wisdom was very slight. To this day, most of them know absolutely nothing of botany, though still able to recite page after page of the large and very dry text-book. So it is with history. A man may know a hundred dates. He may know, for instance, that Magna Charta was signed by King John on June 15, 1215; but if he knows nothing about the document itself, what it meant, who drew it up and why, under what circumstances it was signed and why, he may be said to know nothing about the most interesting document in the history of the Anglo-Saxon race. He may know, too, that the first perfect parliament was summoned by Edward I.; but, if he knows no more, he may with truth be said to be utterly ignorant of an event which John Richard Green has denominated 'the most important event in English history.' Still, books giving such general knowledge of the world's history have their place.

Professor Fisher has undoubtedly put much time and labor into the making of this book. Portions of it are well done — exceedingly well done. It is also very well proportioned, and in its arrangement no fault can be found. We are conscious, too, of the enormous labor involved in getting out such a work. But all these considerations only add to our regret that Dr. Fisher did not use still more care in his original writing, and exercise very much more vigilance in his proof-reading; then he might have produced a book that would have remained the standard work, of its size, for a very long time. Let us call attention to

Outlines of universal history. By G. P. FISHER. New York, *Ivison, Blakeman, Taylor & Co.*, 1885. 12°.

a few errors, which, though trifling in themselves, have given us a distrust of the whole book, and especially of that portion dealing with modern history.

The first sentence is from p. 295, and is as follows: "John (surnamed Sansterre or Lackland, a name given to younger sons who died before they were old enough to hold fiefs) was chosen king." Of course, this statement is absurd. It is singular that Professor Fisher should not have seen it; for the definition is correctly given by Miss Thompson, whose admirable 'History of England' the author seems to have read with some care: "John, surnamed Sansterre or Lackland (a name given to younger sons whose fathers died before they were of age to hold fiefs)." Then, again, take the following from p. 315. The author has been speaking of Llewellyn, and goes on to say, that, "when a rebellion broke out several years later, Wales was conquered, and the leader of the rebellion executed (1273)." Now, of course, the author knows that Llewellyn was killed in a chance skirmish, and that it was his brother David who was executed in 1283, not 1273; but he should have said so. Then, too, on the very next page (316), the date 1292, which is assigned to the defeat of Warrenne by Wallace at Stirling Bridge, should be 1297; while on the following page (317) Isabel is said to have returned from France, bent on the overthrow of her husband, Edward II., in 1325, instead of 1326. Now, here, on three successive pages, are three dates — and three very important dates — wrongly given. No doubt they are misprints, or mere slips of the pen; but the greatest care should have been taken to prevent just such errors. It must not be supposed that such failings are confined to this part of the book, or to English history, as, in whichever direction we have turned, the same want of care has been observed. In American history, in European history, and even in ancient history, similar errors have been found.

The sections devoted to the history of the people — to the literature, theology, art, etc., of the different periods — are good as far as they go. The maps of classical times are mainly printed from the same plates as those in the 'Standard classical atlas,' issued by the same publishers (*Science*, vii. p. 51): those relating to more modern events, while not so large, are clear and fairly accurate. The most serious omission in this part of the book is the lack of a map showing the partitions of Poland. Taken altogether, the maps add something to the value of the work. So, too, do the various genealogical tables; while the little bibliographies, though very general, will serve to start the inquiring student in the right direction. It is to be regretted that an insufficient index impairs whatever usefulness as a work of reference the volume might otherwise have had.

COMPARATIVE DISTRIBUTION OF JEWISH ABILITY.

THE pronounced racial characteristics of the Jewish people, with their remarkable persistency of type, have always rendered them a favorite subject for ethnological study. The peculiar environments in which they have been placed, and the almost constant persecution to which they have been subjected, have certainly given their impression to the mental characteristics of the race, and in many respects we see these as sharply portrayed as the peculiar physiognomic cast.

Mr. Joseph Jacobs has recently published (Journal of the anthropological institute of Great Britain and Ireland, February, 1886) an analysis of the characteristics of more than thirty thousand eminent men with especial reference to the Jewish race. The conclusions he arrives at are of the greatest interest, and in some cases unexpected from the crude inductions of common experience.

Jews have no distinction whatever as agriculturists, engravers, sailors, and sovereigns. They are less distinguished than Europeans generally, as authors, divines, engineers, soldiers, statesmen, and travellers, but approximately their equal as antiquaries, architects, artists, lawyers, natural scientists, political economists, scientists, and sculptors. They seem to have superiority as actors, chess-players, doctors, merchants (chiefly financiers), metaphysicians, musicians, poets, and philologists. One would, however, have expected a much larger contingent of lawyers and political economists than is actually found, and art is better represented among them than one would suppose. The sciences also, both biological and exact, show a greater equality than most people would expect. As regards the former, of course Jews have no Darwin. It took England a hundred and eighty years after Newton before she could produce a Darwin: and as the Britishers are five times as many as the Jews, even including those of Russia, it would take, on the same showing, nine hundred years before they could produce another Spinoza; or even, supposing the double superiority to be true, four hundred and fifty years would be needed. But, even in the lower ranks of biology, Jews have done and are doing good work. Bernstein, Cohn, Remak, Rosenthal, and Valentin as physiologists, Cohnheim, Hirsch, Liebreich, Lombroso, and Traube as pathologists, will be recognized; while F. Cohn is perhaps the third greatest botanist in Germany. It

is in abstract science, mathematics and astronomy, that Jews show to more advantage. The history of pure mathematics during this century would show large blanks if the names of Jacobi, Sylvester, Kronecker, and Cremona, were removed. In astronomy we have the cluster of Herschels, Goldschmidt (who discovered fourteen asteroids in the 'fifties' and 'sixties,' when such discoveries were not an every-day occurrence), and W. Meyerbeer (brother of the musician, and author of the first great chart of the moon). Altogether, then, we must conclude that Jews take their full share in the scientific work of the day. In Sir John Lubbock's 'Jubilee speech at York,' we find eight Jewish names out of the two hundred and eighty-nine who are mentioned as contributing to the last fifty years of science: this is considerably above their proper proportion, even when including the Russian Jews. Again: in M. de Candolle's book, 'Histoire de science,' there are ten Jews holding sixteen out of the eight hundred and twenty-four chairs as foreign members of the scientific academies, which fact he uses as a test of scientific ability. This is just the right proportion, the Jews of Europe being seven out of three hundred and thirty-three million.

Less surprise will be felt at the subjects in which Jews seem to show superiority. In acting, a profession better recognized on the continent than here, — and the same may be said of medicine, — in Austria, one may say *ubi tres medici duo Judaei*. The Jewish merchants who get into the dictionaries are, of course, the great financiers. But it is chiefly in music and philology that Jewish superiority is most marked: in music there seems to be six times, and in philology nine times, as much Jewish talent as European. For the former, besides the great names of Mendelssohn, Halévy, Meyerbeer, and Rubinstein, already mentioned, we have many lesser lights, like Sir Julius Benedict, Sir M. Costa, F. Cowen, Joachim, Pauline Lucca, Moscheles, and Sir A. Sullivan. English music, to say the least, would be almost non-existent without these Jewish names. Even more striking is the number of Jewish names distinguished in philology. These are not alone connected with oriental and Semitic philology, like Benfey and Oppert; but they count a goodly number of classical scholars, — Bernays, Bernhardy, Lehrs, Friedländer, and H. Weil, to whom we may add Freund, the author of the Latin dictionary, which is the basis of all those used in England. The names of Lazarus and Steinthal are known wherever the principles of philology are studied. In modern languages, too, Jews have done good work. Sanders has done for German what Littré did for French; and a Jew, the well-known Ollendorff, may claim to have taught languages to the largest number of people by the clumsiest method of teaching.

If we may venture to inquire into the causes of the Jewish superiority established on these somewhat hypothetical grounds, there are various reasons which can be given. We have to take account of their residence in cities, always more conducive to the life intellectual. From this, too, follows their addiction to commerce as distinguished from industry; and as the former implies headwork, and the latter handicraft, mental capacity must be aided by this fact. The care Jews give to their children's education is well known, and must help. All Jewish boys have hitherto had to learn Hebrew, as well as the vernacular, and this must further mental progress. Dissenters generally seem more intellectual, because they have early to think out their differences from the generality. In the case of Jews, persecution, when not too severe, has probably aided in bringing out their best powers: to a high-spirited race, persecution, when there is a hope of overcoming it, is a spur to action. The solidarity of Jews, and the aid they willingly give to young men of promise, assist in developing whatever talent there may be in the community. The happy home-life of the Jewish people, and the practical and undogmatic character of their religion, together with the absence of a priesthood, have contributed to give the *corpus sanum*, and thus the *mens sana*. Jewish reason has never been in fetters; and finally the weaker members of each generation have been weeded out by persecution, which tempted or forced them to embrace Christianity, and thus contemporary Jews are the survival of a long process of unnatural selection, which has seemingly fitted them excellently for the struggle for intellectual existence.

Turning from these general causes, it would be of interest to discover the reasons for the special ability of Jews in music, mathematics, metaphysics, philology, and finance. The chief cause of the musical pre-eminence of Jews, lies, in all probability, in the home-character of their religion, which necessarily makes music a part of every Jewish home; this, too, was the only direction in which their artistic sensibilities could be gratified. Jewish philology is in part due to their frequent change of country, and also to the fact that they have had an additional sacred language besides the vernacular. As regards finance, the Jews have had their greatness thrust upon them: the world forced them to become financiers centuries before finance became a power, and must not complain if Jews now profit by their start in financial experience. Altogether, the productions of Jewish

intellect strike one as being predominantly abstract, — a result, doubtless, of their long life in cities, and exclusion from nature on the one side, and from the education which lies in handicrafts on the other. We may expect great mathematicians and philosophers from them, but not great inventors, biologists, or painters, till they have had time to throw off the effects of their long seclusion from nature.

RECENT CHALLENGER REPORTS.

Report on the Schizopoda (vol. xiii.). By Prof. G. O. SARS. London, *Government*, 1885. 4°.

THE Schizopoda and Cumacea collected during the voyage of the Challenger were placed in the hands of Professor Sars of Christiania for examination and description, and very wisely, for he had done more to elucidate these groups than all other authors combined. This report, by far the most important addition yet made to our knowledge of the Schizopoda, more than justifies the English authorities in intrusting certain portions of the Challenger collections to foreign naturalists. Fifty-seven species of Schizopoda, representing twenty-one genera, are here fully described and very carefully and elaborately figured by the author himself, who says very truly that the collection "has turned out extremely rich, and of very special interest;" but this result is undoubtedly very largely due to the great care with which Professor Sars has examined the miscellaneous material collected in surface-nets, and submitted to him. Forty-six of the fifty-seven species were first made known by the Challenger expedition, and the elaborate working-out of this large number of new forms from widely different regions and depths affords most important new material for discussing the proper subdivision of the Schizopoda and their relation to the other Crustacea.

Professor Sars, I am glad to see, regards the Schizopoda as a suborder distinct from but closely allied to the Decapoda proper, and retains with them the Euphausiidae, in spite of Dr. Boas' arguments that they should be regarded as a distinct order. He also shows that the genus Eucopia, which has been referred to the Penaeidea by Dana and Bate, is a true schizopod, though representing a distinct family. Thus we have four families of Schizopoda: Lophogastridae, Eucopiidae, Euphausiidae, and Mysidae.

The Lophogastridae, which, previous to the Challenger expedition, was represented by a single genus, is here augmented by the remarkable genus Gnathophausia and two new genera. Of Gnathophausia, which was first made known by Willemoes-Suhm during the progress of the expedition, and contains the largest known schizopods, no less than nine species are here described, one of them over six inches in length. The anatomy of the genus is carefully worked out, and its affinities to Lophogaster well shown. All the species of the family appear to be inhabitants of deep water.

The account of the Euphausiidae is the most important and interesting part of the work. Nearly all the species of this family are pelagic in habits; and Professor Sars' careful examination of the surface collections made on the expedition has not only added largely to the number of species made known, but has enabled him to bring together and describe many of the post-embryonal stages of several of the forms. Twenty-eight species representing eight genera of the family are described, and twenty-three of the species and four of the genera are new. The entire anatomy of several species is worked out, and the articular appendages of nearly all of them are figured in detail. Under the genus Euphausia, the peculiar eye-like organs situated on or between the bases of the legs are very carefully described, and apparently well shown to be luminous, and not visual organs. Although many of the species of the family are often taken in the greatest abundance, egg-bearing females are only very rarely seen; and, until very recently, nothing was positively known in regard to the manner of carrying the eggs, a single long-ago-recorded observation of Bell being somewhat doubtful. Professor Sars, however, has now found species of several different genera, carrying masses of eggs beneath the body in the same position as in other Schizopoda, though not enclosed in a pouch formed of lamelliform appendages, thus confirming Bell's observations and those of the present writer, published in 1884.

In the chapter on the development of the Euphausiidae, post-embryonal stages of species of Nyctiphanes, Euphausia, Thysanopoda, and Nematosceles, are carefully made out, and fully described and figured; and this is all accomplished with what is usually regarded as the refuse from the surface-collecting net. These investigations fully confirm the observations of Claus, Sars himself, Metschnikoff, and the present writer, and show that the typical Euphausiidae are hatched, like barnacles and copepods, as true nauplii, with unsegmented body, no compound eyes, and only three pairs of appendages, and that they pass through a long series of intermediate stages to the adult condition. Sars regards this nauplial development as characteristic of all the Euphausiidae, which seems somewhat doubtful when we consider the small number and

enormous size of the eggs of one of the species of Stylocheiron here described.

The Mysidae were far better known than the other Schizopoda, and the account of the Challenger species is consequently less important than that of the other families; still sixteen species belonging to nine genera are described. A short appendix contains descriptions of four ecto- and two endo-parasites of species described in the report.

The fact that the work was written in a language foreign to the author is scarcely noticeable, and errors are rare. A few mistakes have resulted from changes and additions during the progress of the work, as the failure to change the generic name of Amblyops australis on p. 12, and the incorrect statement of the number of genera and species on pp. 63 and 172.

The numerous excellent plates bear the impress of a Stockholm lithographer, and add to the international character of the work.

S. I. SMITH.

Lamellibranchiata (vol. xiii.). By EDGAR A. SMITH. London, *Government*, 1885. 4°.

THE report on the bivalve mollusks consists almost exclusively of a list of the various species comprised in the collection, with such remarks as appeared to be of interest, and of the descriptions and figures of the species new to science. The anatomical work on those species of which the soft parts were preserved has been placed in other hands, and is not yet published. The Rev. R. Boog Watson retains the gastropods and solenoconchs, but, after doing certain preliminary work, concluded to relinquish the present group, which was very appropriately placed in the hands of Mr. Smith, well known to all students of the invertebrates as the courteous and hard-working assistant in charge of the Mollusca of the British museum.

The Challenger collection of lamellibranchs was obtained from the dredgings at some hundred and fifteen stations, and comprises about five hundred species, of which four hundred and fifteen were found in water less than two hundred fathoms deep, nine in water over two thousand fathoms deep, and the remainder at intermediate depths. The greater part of the collection, therefore, is not of an abyssal character, and, in fact, forms an important contribution to the fauna of the Southern Ocean, and especially Australian waters; but the portion relating to the deep-sea forms is, of course, the most interesting and biologically most important, and will prove indispensable to all students of that branch of biology. The plates are excellent, and the proof-reading good, though we notice the references to plate vii., in the text, all read plate viii. A few species which came in at the last moment are represented by woodcuts in the text.

The collection shows that no special student of the Mollusca accompanied the expedition; for the opportunities were so great, that a qualified collector would certainly have done much better, both as to the number of species collected and in regard to their biography. It must be remembered that the Challenger party worked with much less perfect instruments and methods than are at present available, and that the loss of time incurred by the use of rope in dredging is doubtless accountable for the washing-out of many valuable specimens which actually got into their dredges. Mr. Smith is quite conservative in his estimation of what constitutes a genus, but we are inclined to agree in his decision that only one new generic group is represented in the collection. This is called Silenia, and is distinguished from Lyonsiella by both anatomical and conchological characters. It was found in the deep water of the South Atlantic. The general considerations of the report are brief. The remarkable sporadic appearance of several forms in widely separated localities (Red Sea and Fiji Islands, Canaries and North Pacific, Australia and West Indies, and the like) is instructively commented upon, though perhaps none of the cases are more remarkable than the recent discovery of Pecten pleuronectes by the U. S. fish commission in the West Indies. The wide bathymetrical distribution of certain species, shown for the West Indies in the preliminary notes on the Blake mollusks, is fully confirmed for other regions by the Challenger collection; e.g., Lima multicostata in two thousand and in one thousand and seventy-five fathoms. Neaera, Arca, and Amussium were among the most frequent and most characteristic forms of the deeper water. Callocardia appeared in very deep water, in about the same latitude, in both the Atlantic and Pacific. On the whole, Mr. Smith concludes that the lamellibranchiate fauna of the deeps possesses no special or extraordinary character. The species are fewer than in shallower water, and new or peculiar forms are still more exceptional. No special modification of color, epidermis, or weight, seems to be correlated with existence in the benthal zone; for most of the species found there belong to genera whose representatives are thin and pale, whether they are found in deep or shallow water. A tabular exhibit of the distribution in depth and area, of the deep-water species, would have been a valuable addition to the report, which has an excellent index to the text and plates.

SCIENCE.

FRIDAY, MARCH 19, 1886.

COMMENT AND CRITICISM.

'THE GEOLOGY of the Pittsburgh coal-region' is the title of an interesting paper, recently published, by Professor Lesley. The amount of coal in the Pittsburgh region is estimated at about thirty billion tons, — an amount practically inexhaustible, at least for centuries. During 1884, eleven million tons were taken from the Pittsburgh bed, — an output of about sixty per cent of the whole bituminous coal-production of the state, and about thirty-three per cent of the shipments of anthracite. Concerning oil and gas, however, the author has very different views. He says, "I take the opportunity to express my opinion in the strongest terms, that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is nevertheless, not only geologically but historically, a temporary and vanishing phenomenon — one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject."

THE CORNELL UNIVERSITY REGISTER for 1885–86, which has just appeared, shows an institution in a high state of efficiency. There are upwards of 60 professors, assistants, instructors, and similar officers, and 638 students. Of this number, 604 are undergraduates; and the marked difference in numbers between the upper and lower classes may be taken as evidence of the rapidly increasing popularity and efficiency of the university. As against 84 seniors and 97 juniors, there are 162 sophomores and 239 freshmen. The former figures are those of Amherst, Williams, and Brown, while the latter are not far away from those of Harvard. That this magnificent increase is due to a liberal policy and the judicious use of a large endowment, cannot for a moment be doubted; but it seems strange to find in this great university so important a department as that of political economy represented by an associate professor only, and the whole instruction in philosophy devolving upon one man. We are aware that Professor Schumann has been called to this department at Cornell, and will begin his work next autumn; but at that time Professor Wilson will, we understand, retire from active duty, and philosophy will yet have but a single representative. The rapidly widening provinces of psychology and ethics have long since made it impossible for a man who must also teach the history of philosophy and logic to keep up with their progress; and it is strange that so few of our great colleges seem to recognize this fact. Harvard and Princeton seem to us the only two colleges in which the philosophical encyclopaedia is at all adequately represented.

BOTANICAL INSTRUCTION IN THIS COUNTRY.

BY a slow evolutionary process, botanical instruction appears to be undergoing a radical change in the United States, which concerns both its nature and methods. Whereas only a few years ago botany, as a college study, dealt chiefly with the flowering plants and vascular cryptogams, its scope has broadened, even in the limited undergraduate curriculum, so that the graduate of to-day is supposed to have been taught more or less about each of the principal groups of plants, from the lowest to the highest, if he has studied botany at all. With this change has come an earnest effort to make his knowledge a working-knowledge, obtained in the laboratory so far as essentials are concerned, and merely rounded out in the lecture-room. That Harvard university should be prominent in planning and introducing these changes is not surprising, for nowhere has botanical research and instruction been so favored in the possession of the necessary means and of talented leaders in different branches of the growing subject.

A good library and herbarium form an admirable basis for much systematic work and for a certain class of instruction, but they must needs be supplemented by a garden and museum if the latter is to meet the modern requirements. Botanical gardens are established either to aid in the introduction of valuable economic plants, or as

means of education. Several of the largest gardens owe their origin primarily to the first cause, though they have proved valuable educational agents, and may ultimately have come to be used chiefly for instruction and research; but a considerable number are the property of colleges, and were from the first intended to subserve educational ends. The garden at Cambridge is of this class; and the report of its director, just published, shows that it is growing in usefulness. Beside the general collection of plants that every well-regulated garden is supposed to contain, the Cambridge garden is working toward extensive special collections to illustrate economic botany and the general morphology of phenogams. The groups in the latter, which can well be copied on a smaller scale, even where the name of 'botanic garden' would appear pretentious, are arranged in substantially the order laid down in the common text-books of botany, so that the different forms of leaves, flower-clusters, and flowers, can be easily recognized by any pupil. In connection with the economic plants — intended to exhibit variation under domestication by large suites of varieties of such plants as the cabbage, etc., and to promote the cultivation of vegetables that have come to be prized in Europe, though strangers to our tables — should be mentioned the large economic collection of trees in the Arnold arboretum at Jamaica Plain, which is now reported by its director, Dr. Sargent, to be definitely planned so as to include a general collection of the native trees of eastern Massachusetts, and the most valuable species from other localities, planted singly, to admit of the maximum growth of each species, and also in groups, chosen so as to represent its main varieties, and calculated to show its mass-characters. This loosely planted general collection, arranged for the definite purpose of object-teaching, is supplemented by a more compact experimental and working collection, intended to supply material for study, and especially to receive doubtfully hardy or valuable species and transitory horticultural forms.

While Harvard — the oldest and strongest botanical centre of the country — is thus giving evidence of large resources and progressive intelligence, the fact that similar steps are taking in other sections of the country is not to be overlooked, and is even more indicative of progress, since it implies a wide-spread interest in better instruction and better research in botany. It is very desirable that this feeling may become more prevalent, and receive the financial backing that is necessary if it is to count for much.

So far as experimental work is concerned, persons who know that there is a botanic garden at Washington, enjoying the patronage of the government, might expect much from it, did not the majority of them know, at the same time, that it is so circumstanced as to improve its past record very little until the policy of its management is radically changed. Until then, such work must be done elsewhere; and it is being undertaken by the experiment-stations and agricultural colleges of several states enthusiastically, if, in most cases, with too limited resources. Meantime new gardens are being established and developed under hopeful auspices. The most prominent of these are the newly created Montreal garden, and the private garden of Mr. Henry Shaw of St. Louis, which has recently been placed in relation with the chair of botany of Washington university, and will, it is understood, be so amply endowed by its founder as to become within a few years, if properly developed, a leading centre for research, experiment, and instruction in pure and applied botany.

That these movements indicate a growing recognition of the needs of botany and a disposition to meet them, is suggested by rumors of similar steps soon to be taken in other quarters; so that the outlook for botanical and horticultural work of a high grade is more promising than at any time in the past. What is most to be feared, is that ill-advised influence may place the facilities for this work in incompetent hands, with the result not only of temporary delay, but of permanent disaster. This danger can be avoided only by proper care in the first instance, both in selecting men and in planning work.

DEEP-SEA SOUNDINGS IN THE SOUTH PACIFIC.

THE navy department has received a letter from Commander A. S. Barker, U.S.N., dated Dec. 18, 1885, at Sandy Point, Magellan Straits, in which he reports having made a series of deep-sea soundings from Wellington, New Zealand, across the South Pacific to the Straits of Magellan. Fifty-seven casts were taken during the passage, from Nov. 6 to Dec. 16, over a distance of forty-five hundred nautical miles. The passage was made across that part of the ocean where strong westerly winds prevail, and many of the soundings were taken under trying circumstances. A few gales were encountered, but only one severe

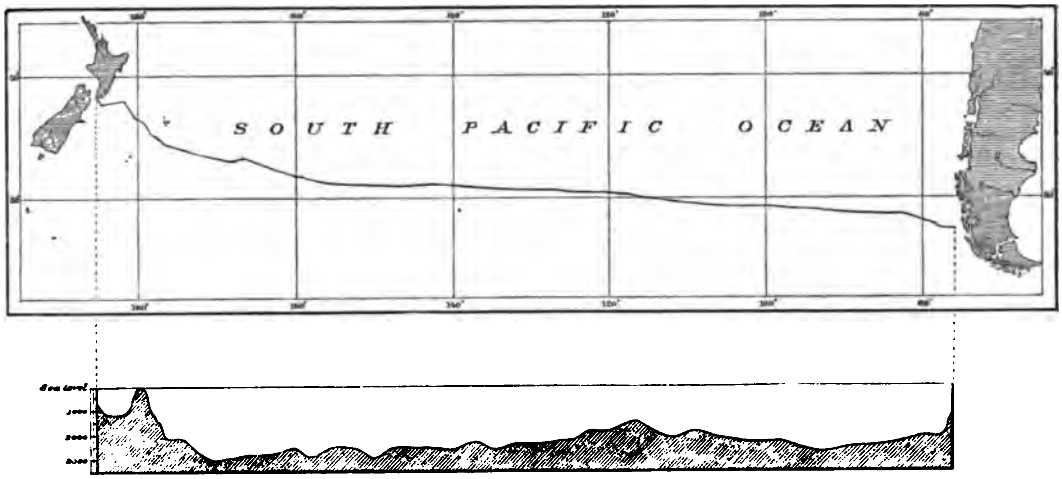
storm; and not a single cast was missed, from 180° west to the Straits.

The sounding-machine used was Sigsbee's improvement on Thomson's, and was mounted on the starboard end of the bridge, which is just forward of the smokestack. The soundings were taken head to sea, the wind a little on starboard bow; the ship was easily kept in this position by spanker, main topsail, and by working the engines slowly. The seas were too heavy to sound stern to wind, as was done by the Tuscarora when she did such excellent work under Commander Belknap.

This line of soundings, running as it does very close to the ice-limit, was chosen by the hydrographic office with a view of completing for the present the deep-sea survey of the lower South Pacific.

In 1875 the Challenger ran a line of soundings in about 40° south latitude. Between this and the line run by the Enterprise, the German ship Gazelle, in 1875, also executed a series of soundings, with somewhat greater intervals between than those of the two lines already mentioned. These three series give a fair idea of the general depths in this part of the Pacific, and will probably be sufficient for all purposes for some time to come. North of the Challenger's line, however, over the entire Pacific, lines of soundings should be run in all directions, and at short distances apart; and the hydrographic office has laid out a plan by means of which this can be done from time to time, by our war ships, most economically and effectively, to accomplish the practical result of determining the existence of dangers to navigation. The energies of the hydrographic office should be directed to clearing up the paths of commerce by searching for reported dangers, and this can only be done thoroughly by means of deep-sea soundings. The scientific consideration of the ocean-bed will naturally follow.

This line of soundings of Commander Barker would seem to show that the main bed of the South Pacific commences just south of Chatham Island, the depth increasing very rapidly for the first 300 miles, until 3,002 fathoms is reached, in longitude 170° west. Beyond this point the profile shows no remarkable irregularities except in longitude 150° west, where there is a depth of 2,915 fathoms, with 2,650 fathoms and 2,506 fathoms on each side. From longitude 135° west the depths decrease quite regularly until 118° west is reached, where the least depth, 1,562 fathoms, was found. Beyond this the depths increase again quite regularly to the base of the continent.



DEEP-SEA SOUNDINGS BY THE U. S. S. ENTERPRISE.
From Wellington, New Zealand, across the South Pacific to the Straits of Magellan.

This rise in the ocean-bed would point to the possible existence of a ridge running generally north and south, and limited, as far as known, by Easter Island, in latitude 27° 09′ south, longitude 109° 25′ west, and Dougherty or Keates Island in latitude 59° 21′ south, and longitude 119° 07′ west. This ridge is also indicated by a sounding of 1,600 fathoms, taken by the Challenger in latitude 38° 43′ south, longitude 112° 31′ west.

The lines of soundings taken by the Challenger and the Gazelle from 100° to 150° west run generally parallel to that of the Enterprise, and show a remarkable uniformity in the depths along the same meridian in the belt of the South Pacific, between latitude 40° and 50° south.

The surface temperatures agree with the results of previous observations for the same seasons and latitudes. It is to be regretted that no temperatures below the surface were obtainable, on account of the absence of deep-sea thermometers; but as the Enterprise is a cruising ship of war, and is not fitted especially for this kind of work, Commander Barker and the officers are deserving of great commendation for the valuable results accomplished. When the specimens of the bottom arrive, they will be sent to the Smithsonian institution for examination and discussion.

J. R. BARTLETT.

U. S. hydrographic office, March 8.

THE DISTRIBUTION OF RAINFALL IN NEW ENGLAND, FEB. 10-14, 1886.

THE rainstorm which occurred in the eastern part of the United States between the 10th and 14th of February of the present year was very severe in the southern part of New England. The amount of rain surpassed that of any preceding storm on record in that portion of New England where it was the greatest. In addition, there was a large quantity of snow and ice upon the ground, which was melted, and swelled the amount of water pouring into the rivers, thus causing most disastrous floods.

The meteorological conditions which attended this remarkable rainstorm are deserving of attention. On the morning of Feb. 11, the pressure in the eastern part of the United States was unusually high. At Anticosti Island the barometer (reduced to sea-level) indicated 30.01 inches; in New England the pressure ranged from 30.9 inches on the eastern border, to 30.6 on the western; while a trough of relatively low pressure, 30.0 inches, extended from the Gulf of Mexico to the lake region. Light rains were falling along the eastern front of this trough in the central states, heavy rains upon the Middle Atlantic coast, and the storm was just beginning in New England. During the day a centre of depression gradually developed in the central states, and the pressure began to fall. The fall was very rapid on the 12th; and on the morning of the 13th the pressure ranged from 29.8 to 29.6 inches in New England, with the centre of the depression, 29.45 inches, over Lake Ontario. During the 13th the storm-centre advanced rapidly down the St. Lawrence valley, but the rainfall had ceased to be excessive. On the 12th, the day on which the greatest rainfall was noted, the pressure conditions were peculiar. A careful charting of the barometric observations made by the U. S. signal service shows that in the morning a well-developed centre of low pressure existed in Indiana, moving northerly. In the afternoon a secondary depression formed on the Atlantic coast, which at ten P.M. was central at Washington. At seven A.M. of the 13th but one centre existed,—over Lake Ontario. The heaviest rainfall, therefore, occurred simultaneously with the development of a secondary barometric depression, south-west of New England. In its development the barometer fell rapidly. Between seven A.M. of the 12th and seven A.M. of the 13th, the fall was 0.54 of an inch at New York, 0.57 at New London, and 0.60 at Boston.

No peculiarities were noted in the other conditions. The temperature remained very nearly stationary during the 11th and 12th at a few degrees above the freezing-point, but rose on the night of the 12th and the morning of the 13th to above 50° F.

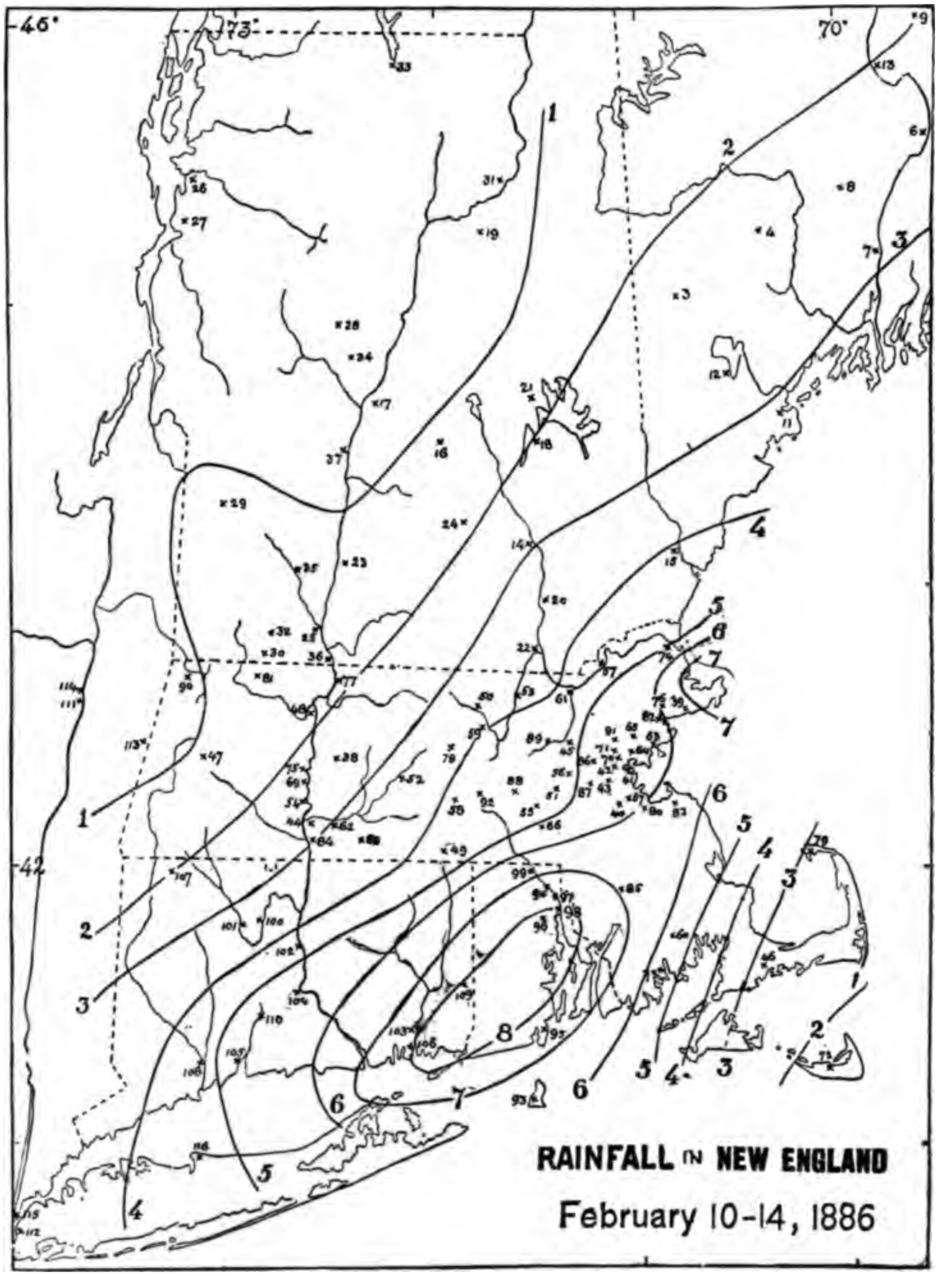
The region covered by the greatest rainfall includes the states of Connecticut, Rhode Island, and the eastern portion of Massachusetts. As there are many observers of rainfall in this region, it has been possible to determine the distribution of the rainfall with considerable approach to accuracy. The special reports collected by the New England meteorological society from one hundred and thirty-two observers show, that, in a region covering more than one-half of Rhode Island and the south-eastern part of Connecticut, over eight inches of rain fell. The amount diminishes rapidly west and east of this region, about two and one-half inches having fallen on Cape Cod, and less than one inch in the north-western part of Massachusetts. The region of heaviest rainfall is situated about two hundred miles north-east of the position of the centre of barometric depression on the afternoon of the 12th.

In order to give a general idea of the extent of territory covered by the rainfall, the following estimate has been made by the help of the accompanying map. The estimate includes the land-surface only.

Amount of rainfall.	Area in square miles.
Over 8 inches	750
Between 7 and 8 inches	750
" 6 " 7 "	1,500
" 5 " 6 "	1,850
" 4 " 5 "	2,750

The above embraces about five-ninths of the total area of the states of Massachusetts, Rhode

Island, and Connecticut. If we assume that the rainfall increased uniformly within the limits of this area, the total amount of water which fell



from the clouds upon this portion of New England exceeded 750,000,000,000 gallons. In this connection the following may be quoted from the report of Desmond Fitz Gerald, C.E., referring to the Boston water-works: —

"The water passing over our lowest dam in the first four days (12th–15th) was 5,120,000,000 gallons, the equivalent of four inches of rain over the whole watershed. The maximum flow was

on the 13th, viz., 2,000,000,000 gallons in twenty-four hours, on seventy-eight square miles of watershed. We have no records showing a greater amount: the nearest approach was March 26, 1876, when the freshet was nearly as great."

The form of precipitation was almost wholly rain, a little snow or hail having occurred at its beginning at a few places only. The rainfall was nearly continuous for about two days and a half, but was not of equal severity. Indeed, the greater part of the fall occurred in twenty-four hours, as is indicated by the following table, which contains the times of beginning and ending of the rain, the total amount, and the amount during a specified interval of twenty-four hours. Similar records could be given from many other stations.

were duly chronicled by the daily press; but it is worthy of note, that, from the geographical position of the flooded region, the damage was confined to a relatively small area. The rivers were affected only near their mouths, while a similar rainfall in the northern portion of New England would have caused wide-spread destruction.

The meteorological records of former years have been consulted for similar instances of excessive rainfall. At Providence, which is in the area of maximum rainfall, there are continuous records since 1832, kept until 1876 by the late Rev. Dr. Caswell, and since that time by the city engineer. There is no instance on record of a rainfall of eight inches, though one exceeding seven inches was noted in July, 1834; and during the week March 20–26, 1876, the amount of 7.66 inches

Station.	Time of beginning.	Time of ending.	Total Rainfall.	Interval of 24 hours during heaviest rainfall.	Rainfall in 24 hours.
			Inches.		Inches.
New York.........	11th, 10.30 A.M.	13th, noon	3.41	11th, 11.00 A.M. to 12th, 11.00 A.M.	2.99
New London	11th, 6.00 A.M.	13th, 4.20 P.M.	8.93	11th, 11.00 P.M. " 12th, 11.00 P.M.	6.66
Providence........	11th, 1.00 A.M.	13th, 11.30 P.M.	8.13	12th, 7.00 A.M. " 13th, 7.00 A.M.	5.65
Boston	11th, 7.45 A.M.	13th, 2.45 P.M.	5.62	11th, 11.00 P.M. " 12th, 11.00 P.M.	4.45
Newburyport......	10th, 5.30 P.M.	13th, 10.30 P.M.	4.78	11th, 9.00 P.M. " 12th, 9.00 P.M.	3.30

The immense amount of water which thus fell in a few hours was of itself amply sufficient to cause disastrous freshets, but it was largely augmented by the snow and ice on the ground. The depth of the snow at the beginning of the rain has been variously estimated. In a few places there was none on the ground, but in the greater part of the region it was found to a depth of from two to fifteen inches. This was wholly melted, and added to the rain as it forced its way over the frozen ground to the rivers. The amount thus added can only be conjectured; for the snow was in many places quite compact, and at the ground there was a thick layer of ice. Several persons have independently estimated that the equivalent of two inches of water was obtained from the snow and ice. This estimate is not excessive, and may be adopted for the region where the rainfall was greatest.

An amount of water, therefore, exceeding ten inches in depth in the maximum area, sought the streams and caused their overflow, with disastrous results. No attempt need be made to estimate the damage to railways, public highways, manufactories, and private property, the details of which

was recorded. It is probably safe to say that in Rhode Island no rainfall has been heretofore recorded of so large amount in a single storm, but there may be records of equally severe storms in other parts of New England; and one which occurred in Connecticut Oct. 3 and 4, 1869, was still more severe.[1] In this storm there were reported at Hartford 8.43, Colebrook 8.44, Middletown 9.37, and Canton 12.35 inches.

The following table contains the total amounts recorded by observers who have kindly responded to the request for their observations. The accompanying map contains the lines of equal rainfall drawn from the observations. The numbers upon the map correspond with those of the several stations in the table. It was found impracticable to print the amount of rainfall at each station on account of the small size of the map. The lines have been drawn freely, and do not follow closely every individual record. In charting rainfall records, which depend so largely upon the location of gauges and the local topography, this is impossible; but it will be seen, from a comparison

[1] See paper by James B. Francis, C.E., in Transactions of the American society of engineers, August, 1878.

of the values of the table with the lines upon the map, that in this case the individual records are quite fairly represented.

Station.	Rainfall.	Station.	Rainfall.
NEW BRUNSWICK.		58..	....
1 St. John	2.46	59..Leominster	8.50
MAINE.		60..Long Plain	5.88
2 Bar Harbor, *a*	3.50	61 Lowell, *a*	4.86
Bar Harbor, *b*	3.70	Lowell, *b*	4.54
3..Bridgeton	2.40	62..Ludlow	2.78
4..Buckfield	2.75	63..Lynn	5.68
5..Eastport[1]	1.54	64..Medford	5.58
6..Fairfield	2.51	65..Melrose	5.60
7..Gardiner	3.27	66..Milford	4.04
8..Kent's Hill	2.47	67..Milton	5.60
9..Mayfield	2.05	68..Monson	8.80
10..Orono	1.85	69..Mount Nonotuck	2.31
11..Portland[1]	3.07	70..Mystic Lake	5.64
12..Sebago Lake	2.38	71..Mystic station	5.11
13..Solon	1.65	72..Nantucket	1.82
NEW HAMPSHIRE.		73..New Bedford	4.51
14..Concord	2.80	74..Newburyport	4.78
15..Dover	3.50	75..Northampton	2.46
16..Grafton	1.08	76..North Beverly	7.66
17..Hanover	0.67	77..Northfield	1.71
18..Lake Village	2.40	78..Princeton	4.07
19..Littleton	0.46	79..Provincetown	2.65
20 Manchester, *a*	3.47	80..Quincy	5.54
Manchester, *b*	3.65	81..Rowe	0.70
21..Meredith Centre	1.75	82..Salem	6.21
22..Nashua	3.71	83..South Hingham	6.51
23..Walpole	1.12	84..Springfield	2.97
24..Warner	1.95	85 Taunton, *a*	6.88
VERMONT.		Taunton, *b*	6.58
25..Brattleboro'	1.57	Taunton, *c*	6.91
26..Burlington	0.33	86..Waltham	6.08
27..Charlotte	0.60	87..Wellesley	5.70
28..Chelsea	0.99	88..Westborough	4.68
29..Dorset	1.12	89..Westvale	4.98
30..Jacksonville	1.61	90..Williamstown	0.99
31..Lunenburgh	0.35	91..Winchester	5.45
32..Marlborough	1.39	92 Worcester, *a*	4.72
33..Newport	0.71	Worcester, *b*	5.29
34..Strafford	0.90	RHODE ISLAND.	
35..Townshend	1.41	93..Block Island[1]	6.22
36..Vernon	1.50	94..Lonsdale	7.69
37..Windsor	0.95	95..Narragansett Pier[1]	7.96
MASSACHUSETTS.		96..Olneyville	8.80
38 Amherst, *a*	2.66	97..Pawtucket	7.92
Amherst, *b*	2.35	98 Providence, *a*	8.18
39..Beverly Farms	6.60	Providence, *b*	9.04
40..Blue Hill	6.13	99 Woonsocket, *a*	6.74
41 Boston, *a*[1]	5.62	Woonsocket, *b*	6.88
Boston, *b*	5.76	CONNECTICUT.	
42 Cambridge, *a*	5.70	100..Canton	8.08
Cambridge, *b*	5.63	101..Collinsville	8.28
43..Chestnut Hill	6.09	102 Hartford, *a*	4.82
44..Chicopee	3.24	Hartford, *b*	4.68
45 Concord, *a*	4.90	103..Lake Konomoc	6.17
Concord, *b*	4.59	104..Middletown	5.80
46..Cotuit	2.79	105..New Haven[1]	8.84
47..Dalton	0.50	106..New London[1]	8.93
48..Deerfield	2.06	107..Norfolk	1.68
49..Dudley	3.88	108..Shelton	4.86
50 Fitchburg, *a*	3.42	109..Voluntown	8.00
Fitchburg, *b*	3.52	110..Wallingford	5.85
51..Framingham	4.64	NEW YORK.	
52..Gilbertville	3.38	111..Albany[1]	0.77
53 Groton, *a*	3.62	112..Brooklyn	8.89
Groton, *b*	3.54	113..Lebanon Springs	0.84
54..Holyoke	2.62	114..Menands	0.87
55..Hopkinton	4.76	115 New York, *a*	8.41
56..Lake Cochituate	4.95	New York, *b*[1]	4.10
57..Lawrence	4.31	116..Setauket	4.76

WINSLOW UPTON.

[1] Station of U. S. signal service.

SOME WORK OF THE GOVERNMENT SURVEYS.

THE work of the topographical department of the geological survey during the past fiscal year shows an increase of thirty-nine per cent over that of the previous season, — a result due mainly to the increased experience and efficiency of the men engaged in its prosecution. The following statement presents in brief form the progress made during the past year, the area being given in square miles: Appalachian section, 22,080; Missouri, 20,000; Cascade, 10,400; Texas, 8,000; Arizona, 8,000; Yellowstone Park, 3,600; Gold Belt, 2,400; Massachusetts, 2,500; New Jersey, 1,500; total, 78,480. Of the maps intended to show the topographic survey of the United States, 88,000 miles have already been completed, and the proof-sheets issued, giving the results in Alabama, Missouri, Texas, Utah, and Montana. Additional work of the department, covering 82,000 square miles, is now in the engraver's hands, embracing the following states: Virginia, West Virginia, Tennessee, Missouri, Kansas, New Mexico, Arizona, Utah, and Nevada. The scale of publication of the survey of Massachusetts and New Jersey is about one mile to the inch; in the South Appalachian section, Gold Belt, Yellowstone National Park, Kansas, Missouri, and Texas, two miles; and in Arizona, Oregon, and northern California, four miles. The draughtsmen of the office have been mainly employed upon work of the originally compiled map of the United States, and the compilation of the map of New York to serve as a basis for the geologic map.

Major Powell has just received a collection of objects illustrating the character of the Oraibi Indians of north-eastern Arizona, consisting of ancient pottery, war-clubs, ancient clothing, musical instruments, and the wooden implements used by them in making fire in connection with their religious rites. There is also a large collection of bone, horn, and stone implements, among the last being many fetiches and carved animals employed in their religious ceremonies. There are also several objects used by these Indians in their marriage and funeral rites, the uses of which have been previously unknown. The material gathered is especially valuable and interesting, as so little is known of these Indian tribes who were first visited by Major Powell about ten years ago.

In the archeological investigations in the south-west, about the ruins of Cañon de Chelly in Arizona, among the curious things unearthed by an exploring party of the geological survey were several fragmentary ears of corn, with one complete and well-developed ear. The latter was found in a grave with a mummified child. It resembles a common ear of red corn, although somewhat smaller; and the grains, even at the present time, are well developed, and fit closely over the entire cob. The antiquity of this corn can be determined as far back as six hundred years. The ruins in which the corn was found are in the same state of preservation as they were when Coronado first visited this country in 1540.

The traditions of the present tribes, as well as the archeological evidences in connection with its discovery, all attest its great antiquity. As corn is supposed to be a native of this continent, its discovery under these peculiar circumstances will aid in throwing considerable light on its origin and history.

HEALTH OF NEW YORK DURING FEBRUARY.

ON the opposite page will be found a graphic representation of the daily mortality in the city of New York for the month of February, together with certain meteorological data for the same period. The deaths are those from all causes, those from a few of the prominent causes which are constantly at work in all populous centres, and those of children under five years of age. These statistics are furnished to *Science* through the courtesy of Dr. John T. Nagle, of the board of health. The large number of those who die after having just commenced to live is a striking feature here, as it is in all reports of mortality. That the number is as low as it is, is accounted for by the few deaths which at this season of the year are caused by diarrhoeal affections; for seven days in the month there having been no deaths due to this form of disease, and in eleven days only one death each day, while the highest was but two deaths. When the spring has fairly set in, and the warm days appear, we shall expect to see this condition change, the disease assuming a more prominent place among the death factors, until, during the intense heat of the midsummer, it will overtop them all, and carry off its victims by the scores. Scarlet-fever was, during the month, a little more active as a cause of death than the diarrhoeal diseases; and yet the difference was so slight that the lines representing the mortality from these two affections cross each other repeatedly, and often coincide. Consumption occupies the most prominent position in the diagram, — a disease which has prevailed in all communities for ages, and which has been the subject of as much study and experimental research as, perhaps, any disease which affects the human race, and yet one which still ravages the world, and appears only in a slight degree to be amenable to treatment. Much has been done by sanitarians to point out the influences under which it thrives, and the means to be adopted to lessen its prevalence; and it is more than probable, that, if the advice which has been so freely given were to be put into practice, the number of deaths would be greatly reduced.

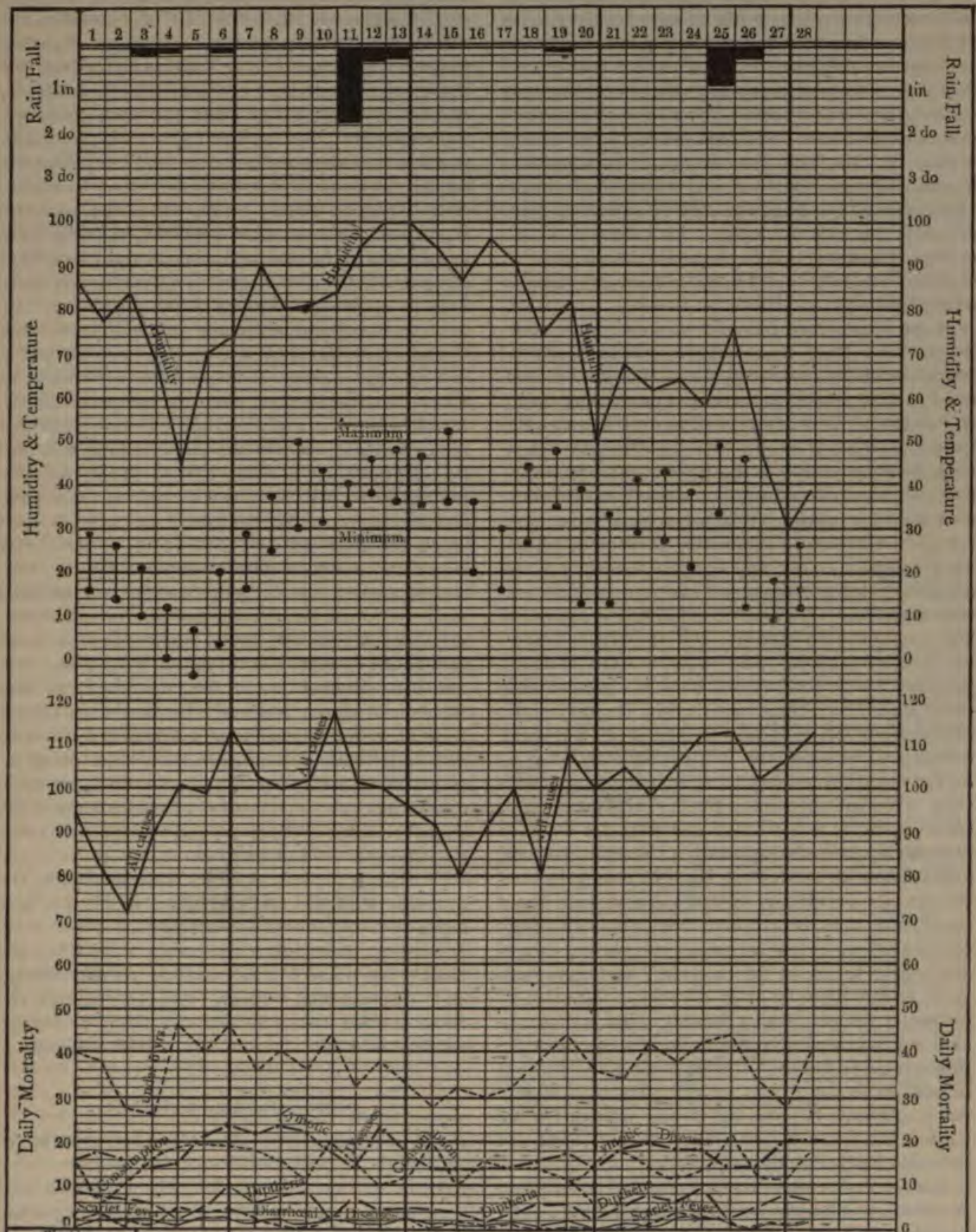
The meteorological data are obtained from the observatory in Central Park, through the kindness of Director Daniel Draper, Ph.D. The instruments from which these observations are made are placed fifty-three feet above the ground, and ninety-seven feet above the sea. The daily mean humidity is obtained from readings taken at seven A.M., two and nine P.M. The 'rainfall' recorded on the 4th as .10 of an inch was in reality 5 inches of snow; the .01 of an inch on the 6th was also snow, which fell to the amount of one-quarter of an inch. These, as is usual, have been reduced to water, and so recorded. February will be remembered as a month in which the thermometer fell to a very low point, —4° F. on the 5th; while on the previous day it was at 0°, and on the 6th but three degrees above that point.

RAILROAD TRANSPORTATION.

MR. HADLEY'S book deserves high praise. It is clear, scholarly, well written, well arranged, temperate and impartial, and yet vigorous and outspoken. It supplies a need which Mr. C. F. Adams's book on railroads filled with great, even though incomplete, success, for matters as they stood ten years ago, — the need of a compact discussion of what the railroad problem is, and what it means. It gives a brief history of the growth of the railroad system, points out the problems and evils that are now before us, and discusses the solutions and remedies. There are excellent chapters on the railroad experience of other countries, and abundant references to the literature of the subject. The book may be strongly recommended, both to those who are specially interested in railroads and the railway problem, and to the general reader who wishes to inform himself on one of the most important of public questions. It is much to be wished that studies of this kind should be read, and not only read, but bought. We have by far not enough of intelligent and careful investigation of our industrial and political problems; and it is a regrettable fact that the publication of such investigations has not been found, as a rule, to be profitable to the publishing-houses, not to mention the authors. The growing importance of such questions, the arousing of public attention to them, the increasing number of thoughtful men who wish information, ought to give a widening circle of readers of books like Mr. Hadley's.

The most important conclusion which the reader who approaches the problem through this book will reach — the conclusion which enforces itself on anyone who gives intelligent study to the sub-

Railroad transportation, its history and its laws. By ARTHUR T. HADLEY. New York, *Putnam*, 1885. 8°.



Weekly Mortality	655	721	652	722	
Weekly mean Thermometer	13.5°	36.4°	33.4°	27.8°	
Weekly mean Barometer	30,005	29.979	29.863	29.820	

ject, but which, unfortunately, has impressed itself but little on the public mind — is, that there is no one solution of the railroad problem, and no one remedy for the evils which exist. The problem is a vast and complicated one: in truth, there is not any one problem. There are a number of different problems: and it is not the least of the merits of this book that it clearly distinguishes them. Perhaps the best part of the book is the discussion of the most difficult of them all, — the question of railroad-rates. Mr. Hadley makes a plea, unanswerable in its essentials, in favor of the much-maligned and much-abused principle of charging 'what the traffic will bear.'

Some things we have learned on these problems; but a great deal more must be learned, and learned chiefly from experience, before the railroad system settles down into a permanent form. For example, it is pretty well agreed, even in this land of non-interference, that government regulation in some form is desirable. Almost every state in the union has its railroad commission. But how far public interference shall go, is quite an open question. There are those who believe that it should go far, and that the tendency is and should be toward eventual state ownership and management. German economists have adopted this view pretty generally, and they have followers in this country. They may be right; but experience up to the present time is by no means clear in favor of their view. Mr. Hadley, in his chapters on the railroad experience of European countries, and especially in his concluding chapter on the results of state railroad management, shows that, even in continental Europe, the question of state railroads is by no means settled. Only in Prussia is state management an established fact, and apparently a success. But in Prussia the conditions are peculiarly favorable; and even there the future must be awaited, before we can judge of the system. How far public regulation can go and ought to go in this country, at the present time, is still more an open question. Mr. Hadley evidently believes that a federal railroad commission is pretty sure to come in the future, and believes it to be desirable. But he does not commit himself as to the extent of the powers it should have, although he presents strong reasons for its having, at least at first, only advisory, and not judicial or administrative powers.

In his chapter on competition and combination, Mr. Hadley expresses strongly his opinion that the economic principles which apply to most forms of production and trade do not apply to railroads. In fact, he says that the law of competition, as laid down by Ricardo and his followers, is 'false in theory,' so far as railroads are concerned. I must confess that this seems to me to be overstraining the matter. Whether one considers the theory to be false, depends very much on what is one's conception of it. Correctly stated, the theory of Ricardo and of 'orthodox' economists, simply says that, given such and such premises, such and such conclusions follow. If the premises do not correspond to facts, the theory does not apply. Perhaps it 'breaks down;' but does it become 'false in theory'? No doubt the premises correspond, in important respects, to facts, in a less degree in the case of railroads than in almost any other branch of industry. The theory, then, fails to apply in a corresponding degree, and we must approach the economic problem from other points of view. But Mr. Hadley himself points out that the theory is by no means without its force and application, even in railroad matters. He tells us in one place that, "where the profits of an existing concern are high enough to tempt it, a competitor will come into the field" (p. 103), and refers to the West shore road as a conspicuous instance. And elsewhere he tells us that when the legislature of Wisconsin, by the Potter law, fixed rates at unremunerative figures, railroad construction stopped, facilities on existing roads could not be kept up, and the state was compelled to repeal the law. "The laws of trade could not be violated with impunity" (p. 135). Are not these applications of Ricardoan laws, at least after some rough fashion? No doubt we cannot solve all economic problems by these laws, and no doubt, in some directions, the development of industry in modern times requires us to apply them more and more cautiously. But we should not therefore throw them entirely overboard, as if they did not yield us any help at all.

But this is a question which interests chiefly the economic student: and perhaps, after all, it is only a question of choice of language. There is no ground for substantial difference with what Mr. Hadley has to say in his chapter on competition and combination. There, and throughout the book, are the marks of thorough study and clear-headed thinking. F. W. TAUSSIG.

MINOR BOOK NOTICES.

Reiseerinnerungen aus Algerien und Tunis. Von Dr. W. KOBELT. Frankfurt-am-Main, *Diesterweg*, 1885. 8°.

IT is curious to contrast this ponderous and thoroughly scientific work of a German physician with that of the vivacious Monsieur Melon, which we noticed some time ago, — the one so chatty and superficial, the other so dull and accurate. We read the Frenchman's book, and cast it away without the slightest thought of ever looking at it

again. We laid Dr. Kobelt's volume aside with the intention of referring to it whenever any thing is wanted concerning Algeria and Tunis. No doubt the Germans have a lack of perspective. To many of them a fact is a fact, to be investigated and recorded: and their books are therefore often wearying in the extreme. But, after all, they do the work. They accomplish results which never have been and never will be accomplished by the French method of grabbing at whatever is picturesque and entertaining, and flinging the rest contemptuously aside. In the present volume the author has done his work conscientiously and well. Portions of it are dreary reading; but there are many interesting chapters. Especially worthy of mention are three chapters on the ethnology of the countries visited, — the eighth, on Algeria and its inhabitants; the eleventh, dealing with the Kabyles; and the twenty-third, on the Tunisians. His route was *via* Marseilles; and the first chapter, describing that city, is one of the very best in the book. In short, American travellers who intend writing up their journeyings would do well to imitate in some measure the methods of Dr. Kobelt. The volume is well illustrated, both with photographs of scenery and of natives. It contains also an appendix of considerable value, by Dr. O. Boettger, describing the reptiles and amphibia collected by the author in North Africa. Besides the lack of an index, the volume is deficient in that it contains no map. This is the more to be regretted, as the learned doctor's route is by no means easy to follow on any but a recent German map of Algeria and Tunis, and recent German maps of those regions are to be found in this country only in our larger libraries.

Römische chronologie. Von L. HOLZAPFEL. Leipzig, *Teubner*, 1885. 8°.

IN his 'Roman chronology' Dr. Holzapfel aims at correcting Roman dates, as commonly given, by a minute process, which, at least as regards the earliest dates, is certainly its own best refutation. He deals also with the various Roman eras in current use among the ancients. Finally, he attempts to give a detailed account of "the course of the Roman calendar down to the time of Caesar's reform." In 1859, Theodor Mommsen, guided by a practical good sense, which Dr. Holzapfel hardly possesses, dealt with all these questions in his 'Roman chronology.' Though in many details Mommsen's conclusions can no longer be accepted, notably as regards the chronological significance of the appointment of a dictator *clavi figendi causa*, it is still true that Mommsen's book is the best upon the subject. The cardinal fault of Dr. Holzapfel's work is, that it is inextricably incomprehensible without the unremitting labor of constant reference to what has been written by others. The reader is distressed by a needless clatter of controversy, which seems to indicate that Dr. Holzapfel does not sufficiently trust his own conclusions. All who are not actually bearing the brunt of the chronological fray will find this book unrefreshing and confusing; and those who are well read in the whole subject may well pause before tormenting themselves with our author's argumentations. The book is conspicuously lacking in neatness of statement. There is no sense of proportion, no prospective. The 'peasants' calendar' and the business year of ten months are practically ignored. And yet what could be of more importance than the former, in any account of the conditions which made Caesar's reformed calendar a possibility as well as a necessity? It is to be lamented that Dr. Holzapfel could not find time to make his book both shorter and more complete. This 'Roman chronology,' with its tediously paraded controversies and its sophomoric list of emendations, ostentatiously placed at the end, is an overgrown 'doctor's dissertation' rather than a desirable book of reference.

A text-book of inorganic chemistry. By VICTOR VON RICHTER. Authorized translation by Edgar F. Smith. 2d American from the 4th German ed. Philadelphia, *Blakiston*, 1885. 16°.

THAT Professor Smith's translation of Richter's useful text-book of inorganic chemistry has passed to a second edition, is perhaps sufficient testimony to its value. Much has been rewritten, and some new matter incorporated; but the work would have gained in clearness and smoothness if more attention had been paid to the rendering of the sense, rather than the phraseology, of the original.

Spectrum analysis. By Sir HENRY E. ROSCOE. 4th ed. by the author and by Arthur Schuster, Ph.D., F.R.S. New York, *Macmillan*, 1886. 8°.

THE fourth edition of Roscoe's 'Lectures on spectrum analysis,' wholly revised, almost wholly rewritten, and including concise accounts of such recent advances of importance in spectroscopy as lend themselves to popular treatment, follows closely the plan and arrangement of its predecessors, and appears in the same elegant guise. The character and scope of the work are too well known to need extended comment.

ST. PETERSBURG LETTER.

ON the 11th of February there was a special meeting of the Geographical society, in honor of N. M. Prjevalsky. The large hall of the Michael palace, where the meeting was held, was crowded by a distinguished audience. In a short preliminary address, the vice-president, P. P. Semenow, spoke of the merits of the traveller, and reminded

his hearers that in his absence this time, Prjevalsky had received two of the highest honors conferred on travellers, — the Vega medal of Sweden, and the gold medal of the Italian geographical society.

It is impossible to see and hear the celebrated traveller without being struck with his fitness to do so difficult and extraordinary a work. With an iron constitution, a rare force of will, the still rarer faculty to command, and communicate his enthusiasm to the picked men who followed him, it was possible for the small band of twenty Russians to explore thousands of miles in the heart of Asia, on the highest plateaus of our globe, amid the greatest hardships and often dangers.

In going to so distant a country and one so difficult to explore, the personal comforts of the travellers had to be sacrificed, their stock of food consisting of *dzamba* (wheat or barley flour roasted) and brick-tea, animal food being furnished by the chase. Their principal baggage consisted of arms and ammunition, as their safety, as well as the success of their zoölogical collections, was dependent upon them. Perhaps the greatest hardship encountered by the expedition was the want of good fuel with which to warm themselves, cook their food, and make tea. The greater part of the countries traversed is treeless, and dried dung the only fuel. This is tolerable in winter, spring, and autumn, when the wind is from the north. Then Thibet is generally dry: but in summer it rains nearly every day, and snows sometimes, and the air is rather humid.

The principal results of this fourth expedition of Prjevalsky consist in an extension of the surveys westward from north-eastern Thibet to countries absolutely unknown. Now they are connected by lines of surveys eastward to Prjevalsky's former road-surveys, northward to Lake Lop-Nor, and westward to the existing Russian and English surveys in Chinese Turkestan. This expedition has proved that very high chains of mountains, with peaks over twenty thousand feet high, rise southward from the lower northern plateaus of high Asia (as Zaïdam, the basin of the Tarim, etc.), and that these mountains trend from west to east, there being no meridional chains. There are no large glaciers in the greater part of these mountains, but there are enormous ones on the northern slope of the Kiria chain (so named from the city and oasis at their foot, in Chinese Turkestan).

The annual commencement of the St. Petersburg university was held Feb. 20, in the large university hall. The report was read by Professor Wassiliewsky, and began, as usual, with necrological notes on deceased professors or honorary members of the university. The chief remarks were devoted to the celebrated historian of Russia, Professor Kostomarow, and to N. W. Kalatschow, an eminent archeologist. Statistical notices followed. The number of students by faculties, was, compared with the last two years —

Year.	Physico-mathematical.		Historico-philological.	Oriental languages.	Law.	Totals.
	Mathematical.	Natural sciences.				
1884	534	568	253	57	834	2,246
1885	485	552	263	76	906	2,282
1886	531	487	252	79	981	2,2[illegible]0

It is seen from this table that the university has a large number of students; and this is the more remarkable, since it has no medical faculty, and this faculty in other Russian universities has more than one-third of all the students. The most notable feature of the changes in the last two years is the increase in the number of law students. By far the larger number of Russian students, after passing their examinations, enter the state service; and law studies are preferred, as giving a better opening than the other faculties. The decrease of the students in natural science is caused by the easier admission into the Medico-chirurgical academy and higher technical schools. A few years ago this academy abolished its first two 'courses,' which gave a general preparation in natural sciences, retaining only the last three special courses. Thus the medical students were compelled first to enter one of the Russian universities; and the medical faculty at Moscow, and the section of natural sciences at St. Petersburg, were crowded far beyond their available room and means of their existing museums and laboratories. The return to the old system at the Medico-chirurgical academy, and the somewhat easier admission at some of the technical schools, have freed the university of a great number of such students, to the profit of the others.

Then followed a lecture by Professor Woeikof, "On the cooling of the globe in connection with the distribution of temperatures in the solid crust of the globe and the ocean;" after which the rector, Professor Andreïewsky, mentioned the medals and other marks of distinction received by the students. Besides these, the university awarded one of the Tljenkow premiums of five hundred rubles to P. T. Brounow, for his works on cyclones and anticyclones in Russia, one of which has been printed in the Proceedings of the Geographical society.

It is interesting to mention a feature of Russian

university life [which is developed nowhere so much as at St. Petersburg : it is the large number of students who receive 'stipends' (scholarships). About one-fourth of the students (in all, 577) receive regular scholarships ; and, as those of the first year are excluded from them, the percentage is much higher in the three later years. The yearly expenses of the university in 1885 were four hundred and thirty-five thousand rubles.

O. E.

St. Petersburg, Feb. 26.

NOTES AND NEWS.

THE Rev. W. C. Winslow, 429 Beacon Street, Boston, treasurer and vice-president of the Egypt exploration fund for America, writes as follows : "The invaluable labors of our society in the Delta were successfully resumed in December. The splendid results of 1883–84 and 1884–85, for classical, historical, and biblical elucidation and illustration, are familiar to scholars and to a large portion of the reading public. The work is in the hands of masters ; but these labors cannot go on without continued support. To those who contribute so small a sum as five dollars the elaborate memoir of the season, annual reports, etc., are sent. The book 'Naucratis' (forty plates and plans) is in preparation ; 'Tanis II.' (Zoan) will follow. The officers and the committee all give their services gratuitously. To all interested a circular and other information will be gladly furnished by the treasurer."

— The winter habitat of the mackerel is not yet definitely ascertained. It is interesting, therefore, to place upon record the fact, noted in the circular of the Boston fish bureau of March 5, that the schooner Fitz J. Babson of Gloucester was struck by a heavy sea on the 27th of February, when about twenty miles north of Georges Banks. When the water had disappeared, eight mackerel were found flipping about the deck. The spring mackerel fleet is being fitted out somewhat earlier than has been usual in former years, on account of this indication of the proximity of the mackerel schools to the coast.

— A committee of geologists and naturalists invite subscriptions to a monument to Oswald Heer, whose death two years and a half ago closed the work of one of the most eminent naturalists of this century. It will take the form of a marble bust on a stone pedestal, to be placed under cover in the Botanic garden at Zurich. One thousand dollars are desired, and those willing to contribute are invited to send their contributions to Dr. C. Schröter, Professor, Hottingen, Zurich, before the first of May next, or to the editor of *Science*, 47 Lafayette Place, New York, who will see that they are forwarded.

— Dr. Austin Flint, the most celebrated of American physicians, died in New York, March 13, aged seventy-four. Probably no one person has ever exerted so great an influence in medical education, and in the medical profession of America, as has Dr. Flint through his text-books and teachings.

— Professor Ward's 'Sketch of paleobotany' (Fifth annual report, U.S. geol. surv.) is an excellent work, and one to which the title does not do justice. The work comprises biographical sketches of twenty-two of the most eminent leaders of the science, followed by a 'sketch' of the early history and subsequent progress of paleobotany, which must have involved a large amount of labor. After this follows a discussion of the classification of fossil botany. Between eight and nine thousand species of fossil plants are now known, two of which are from the Cambrian, nearly fifteen hundred from the carboniferous, and over three thousand from the miocene, with only sixty-nine from the trias, and less than four hundred older than the carboniferous. In his introductory remarks upon the inter-relation of geology, paleobotany, and botany, the author expresses surprise that the mutual dependence of botany and paleobotany has received so little recognition among scientific men, and presents the importance of studying fossil and living plants together. Certainly with this view every naturalist ought heartily to concur. What he complains of in fossil botany has been unfortunately too true in other branches of paleontology.

— Mr. Gilbert's report on the 'Topographic features of lake shores,' in the 'Fifth annual report of the geological survey,' is of especial interest from the author's wide experience on the 'fossil' shore-lines of the evaporated lakes of the Great Basin, and from his studies of the former expansion of Lake Ontario, now in progress. The several topographic forms are well defined, and illustrated by maps and views. The plates of the Cup Butte and other portions of the old Bonneville shore-line in Utah are particularly valuable. A large share of shore-work is attributed to the waves and littoral currents of great storms, just as the greater part of river-channel topography is determined by the heavy and exceptional floods. The bars at the western end of Lake Superior are adduced in illustration of the statement that the greatest waves, and not the prevailing winds, of a shore, will define its topography.

— Mr. Westwood Oliver, with the assistance of a number of astronomers, has in preparation a

practical manual of 'Astronomical work for amateurs,' the aim of which will be to help the possessors of limited instrumental means to turn their attention to astronomical researches of real scientific utility, special attention being directed to the comparatively new fields of spectroscopy and celestial photography. The book will be published by Messrs. Longmans & Co. Mr. Oliver, in the mean time, invites suggestions from practical workers, which may be sent to him at Lochwinnoch, Scotland.

— 'The weather journal' (Cincinnati, *S. S. Bassler*) is the title of a new weekly paper to be devoted to the general meteorology of the eastern United States, illustrated by tri-daily charts of the movements of the atmosphere and the distribution of atmospheric pressure and temperature.

— The wealth and richness of the illustrations of Mr. I. C. Russell's 'Recent glaciers of the United States' (Fifth annual report, U. S. geol. surv.) would alone give his work value, but they serve only to embellish what without them is a very interesting treatise. Some of the engravings of Mounts Shasta and Dana are especially striking. One is surprised to learn of the extent to which glaciers occur in the United States throughout the northern Sierra Nevada and Rocky mountains, while in the Cascade Mountains are numerous ones, flowing through narrow defiles and over precipices, and, as the author says, by no means unworthy of comparison with the ice-fields of Switzerland and Scandinavia. In Alaska the catalogue is still further extended, embracing numerous examples of alpine glaciers as magnificent as any in the world.

— Professor Chamberlin's paper, in the 'Fifth annual report of the U. S. geological survey,' on artesian wells, is one that cannot help but be of practical value. It was the author's aim to include in convenient form such information relative to the qualifying conditions of artesian wells as may be capable of brief, general statement, and may seem to be serviceable alike to citizen, driller, and geologist; and he has evidently succeeded.

— Some novel and interesting applications of instantaneous photography to the study of the movements of the heart and intestines have recently been made by Dr. W. G. Thompson. Photographs of rabbits', pigeons', cats', and frogs' hearts were made in different stages of systole and diastole, showing the action more clearly and accurately than is possible by other methods. In addition to the value of such in physiological teaching, the most practical application of the method will be the illustration of the changes in the form of the heart and intestines produced by drugs; and the author believes the process may be further extended to the study of the contractions of the stomach, bladder, and diaphragm, and other viscera.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The trade in spurious Mexican antiquities.

A NOTE supplementary to my paper on Mexican pottery, published in your issue of Feb. 19, may be of interest to a number of readers.

The fradulent specimens referred to reach this country in two ways, — through the agency of travellers who purchased them in Mexico, and through traders who ship them to New York in large lots. From recent observations I have reached the conclusion that there are now in the collections of this country specimens valued at many thousands of dollars, yet which, since they are fraudulent and in every way vicious, are not worth the trouble of breaking up and casting away. Peru is hardly less fully represented, as the factories in that country have been at work for a number of years.

The detection of modern work is in many cases a difficult matter, but in others a decision is easily reached. With reference to the Peruvian frauds, it may be taken for granted that new-looking specimens are new, and, besides, that many old-appearing pieces are new. If exterior appearances are not sufficient to satisfy the collector as to the age of suspected pieces, let him break some very narrow-necked vessel, either of the light terra-cotta colored or of the black ware, and he will probably find that the inside is innocent of any stain of age.

I may add that objects of stone from both of these countries need careful inspection.

W. H. HOLMES.

Washington, D.C.

The anachronisms of pictures.

The articles of Professors Holder and Lockwood (*Science*, vii. 220 and 242) remind me of what I saw many years ago in one of the ladies' magazines, — a picture of the embarkation of the Pilgrims from Delft Haven, with steamships at anchor in the bay. An enterprising artist! — only about two hundred years ahead of his time, and the picture probably 'drawn by our artist on the spot.' C. G.

Homer, N.Y.

Is the dodo an extinct bird?

It is very improbable that the dodo has been found in the Samoan Islands, alive or fossil. It inhabited the islands of Mauritius and Bourbon in the Indian Ocean. The bird alluded to by Mr. Hopkins as still living in Samoa is probably the Didunculus, a specimen of which I well remember in the collection of Sir William Jardine, the famous ornithologist. Sir William thought the Didunculus was allied to the dodo and the pigeon. W. S. SYMONDS.

The camp, Sunningdale, Feb. 29.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 19, 1886.

VIEWS OF ECONOMISTS ON THE SILVER PROBLEM.

I.

WHAT laws should congress enact, regulating the coinage of silver at the present juncture? To this question, nakedly put, I am obliged to answer that I do not know. The reason I do not know is, that I am not in possession of the minute knowledge necessary to enable me to give a satisfactory answer to the question. It is extremely necessary to the smooth and orderly course of business that the current dollar, when measured in terms of human labor, should vary as little as possible from year to year and from generation to generation. If we compare the value of the gold in a gold dollar with the value of the silver in a silver dollar, we shall find that the former, instead of being equal to or less than the latter, as it was up to 1873, is twenty-five per cent greater. Taking gold as a standard, the value of the silver in a dollar has fallen twenty per cent. Taking silver as the standard, gold has appreciated twenty-five per cent. If the silver dollar is the least variable one, then silver coinage should be free, provided that the proper quantity of silver is put into the dollar: otherwise gold should be the standard. Thus the first question which meets us is whether the silver or the gold standard is the least variable, when measured in terms of human labor.

Now, this is a question of fact, to be settled, not by speculation or by abstract reasoning, but by a careful and exhaustive analysis of manufactures, prices, wages, and industry, not only in this country, but in the leading countries of the world. Without this analysis, nothing I could say on the subject would be final. It would take me a year, and would require help from a great number of experts, to make the necessary statistical investigation; and I have not the time to do this. When considering the problem, I feel as if on board a ship in a narrow channel, on a dark night, listening to a discussion among the sailors as to whether they shall steer to the right or left. If they ask me what they shall do, I answer, that the only way I see to proceed is to take soundings from point to point until they determine, as nearly as possible, where the middle of the channel is, and then to follow it as closely as they can.

Have I, then, no impression or views whatever on the subject? I reply, that I have no views so well founded but that I would like better ones before advising action. My impressions I am ready to give, with the proviso that I retain the right to reverse them to-morrow if any new light of a nature to change them is thrown on the subject.

Firstly, to begin with the subject in its more remote and general bearings, I am of opinion that a dollar composed of a fixed weight of either of the precious metals will not serve the purposes of the world's business indefinitely. The increase of wealth must, it seems to me, make gold more valuable, unless the supply is continually increased. Without being able to give an exhaustive investigation of the subject, the impression which I have derived from statistical tables is, that the consumption of gold in the arts the world over is now fully equal to the annual supply, and is continually increasing. If the latter is not increased, the former will speedily exceed it, and then the stock of gold on hand, and available for money, will slowly diminish. The necessary result will be an appreciation harmful to the standard.

Secondly, although I look upon this appreciation as inevitable at some future time, the weight of evidence seems to me to be in favor of the view that it has not yet commenced, or at least has not taken place in a serious degree. It is true that this statement runs counter to the impressions which one derives from tables of prices, and especially from the tables published from time to time by the London *Economist;* but there is a defect in these tables which has not been sufficiently taken account of. The prices are mostly those of metals, grains, and other comparatively raw materials, which are made and sold on a large scale. Now, the production of these staples has been enormously increased in late years by the opening-up of new sources of supply, and the invention of improved methods of extraction and production. Besides, they represent but a small fraction of the total product of human labor. They cannot, therefore, afford us the required basis of comparison.

What we should principally depend upon are those articles in whose production no great improvement has been made. We should also take

them in proportion to the quantities produced or consumed. About a year ago I made an approximate determination of this kind, with the following result: a certain collection of the necessaries of life, representing a nearly fixed amount of human labor, had the following values at different periods: [1] —

In 1876	the collection	was	worth		$111.66
" 1880	"	"	"	"	98.27
" 1884	"	"	"	"	101.38

Assuming that the absolute value of the above-mentioned collection of the necessaries of life, measured in terms of human labor, remains invariable, and that it is the standard dollar which changes value, then we see that the latter did really appreciate between 1876 and 1880, but slightly depreciated between 1880 and 1884.

Another test is afforded by the price of a house, because, taking it altogether, it requires as much labor to build a house now as it did ten or twenty years ago. So far as I can learn, the cost of such a building is higher now than it was ten years ago, and has not diminished any for several years past. I conclude, therefore, that house-builders in general can, on the average, earn as many standard gold dollars now in a day as they ever did.

A third test is afforded by the rate of wages. Professor Hadley's 'Connecticut labor report' shows that in Connecticut the rate of wages was the same in 1885 as in 1880: hence Connecticut operatives earn as many gold dollars now as they did in 1880.

Up to the present time we have actually had the gold standard, since the value of our silver dollars has been kept up to that standard by restricting their coinage. Were we to make the coinage of silver free on the present basis, it would cause a sudden and disastrous fall of twenty per cent in the standard. It is clear to me that this should not be permitted. If any more silver is coined, each dollar should contain a dollar's worth of metal, as measured by the standard which has prevailed during the past ten years; that is, the dollar should contain about 520 grains of standard or 468 of pure silver. I think all parties might well agree on this policy for the present. But they should all unite in demanding the creation of a government commission, composed of men wholly above the ordinary influence of politics, to determine how the standard dollar is actually changing when compared with human labor, and to make known the results of their investigation from time to time. SIMON NEWCOMB.

[1] The table on which this is founded is given in my Principles of political economy, p. 211.

II.

THE so-called 'silver question' is one of the most complicated and difficult issues in our politics now pressing for solution. It has excited an immense amount of debate which has been partisan and ignorant, even beyond the ordinary run of political discussion. This arises from a number of circumstances, two of which are especially important; viz., (1) that the decision of the matter involves pecuniary interests of enormous extent, and (2) that some of the most important facts necessary to an intelligent decision are not attainable by any means now within our reach. The lack of accurate knowledge has led many to indulge in the most unwarranted flights of fancy, while the feeling that one line of action or the other might interfere with vested interests has lent the personal element so visible in all debates on the subject.

I can do but little, in the space accorded me, toward discussing the question in its broader aspect, and shall therefore limit myself to a criticism of some of the most common arguments advanced by those who oppose the re-establishment in this and other countries of the so-called double standard.

1. The attempt is made, by those who oppose the re-establishment of the so-called double standard, to cast a slur upon their opponents by representing them as quacks who desire to try dangerous experiments on the body of a healthy patient. This is very good rhetoric, but very poor science. It is only within about fifteen years that any general experiment has been made in the civilized world to substitute a single gold standard for the so-called double standard. Since that time it would seem as if there were but one phenomenon common to all civilized nations, and that is, commercial and industrial depression, — depression in which protection and free-trade countries, republics and monarchies, small and large states, manufacturing and agricultural communities, have alike shared. Labor difficulties, agricultural ruin, commercial decay, form the subject of numerous reports and commissions in all European countries. In a word, the patient is not in a healthy condition at all. In fact, it would appear, on a close examination, as if he were in a very bad way indeed; and it is not by any means clear that his present sad state is not greatly aggravated by the attempt which the gold doctors made some fifteen years ago to discard the treatment which had prevailed in this sphere for centuries previous. So far, then, from being open to the charge of wishing to make unnecessary experiments, the silver doctors may claim that they merely ask for a return to a course of life under which the industry of the world had developed up to 1870,

and from which the gold doctors persuaded the world to depart at that time, with the unsatisfactory result now before us.

2. The attempt is also made to make the advocates of bimetallism in this country appear as favoring a breach of faith. This is, of course, a serious charge, and is deserving of careful consideration. We began in this country with the system of so-called double standard under which a man might pay his debts, either in gold at the rate of 24.75 grains of pure gold to the dollar, or in silver at the rate of 371.25 grains of pure silver to the dollar. This plan continued until 1834, when the amount of pure gold was changed to 23.20, and in 1837 to 23.22, silver remaining unchanged. It was expected, of course, that under this system the debtor would use the cheapest metal, and would pay in gold or silver, according as it was easier for him to get 23.22 grains of gold or 371.25 grains of silver in the form of dollars. This device was deliberately adopted in 1794, after full discussion, as being calculated to further the monetary and industrial interests of the country by keeping up the supply of money. It was continued without change until 1873. As a result of the change in valuation of the gold coin in 1834, it was cheaper for the debtor to pay his obligations in gold than in silver; and the latter metal disappeared from circulation, leaving a currency, so far as it was metallic, of gold alone, if we except the token-silver currency, which was a legal tender only to five dollars.

In 1873 this option of paying either in gold or silver was taken from the debtor by a modification of our coinage laws. About the same time the value of silver began to fall. Under a metallic currency, this would have led to the payment of debts in silver, if the law conferring the option of paying debts in either silver or gold had not been repealed in 1873. All debts contracted prior to 1873 had been contracted under this option. This option was a part of the contract; and the debtor had a perfect right to complain if the law interfered to take it away, and thereby practically increase the burden of his obligation. Legally speaking, then, the debtor had the right to insist that he should have the option of paying in silver; and all talk about the debtor trying to evade his obligations, or taking refuge behind the law, and therefore deserving reprobation, is not to the point. He is simply trying to do what our laws encouraged him to do up to 1873, with the idea that his taking advantage of the law would further all interests in the country by forcing a recourse to the cheaper metal when one of them became too dear.

The case is still further complicated by the fact that the general demonetization of silver hastened its fall in price, thus widening the distance between the value of gold and silver. The creditor class pointed to this great disparity, which they had themselves increased by their influence in government, as a proof of the great injustice which would be done by continuing the option of paying in silver. The debtors answered, that, if they had been allowed to exercise the option which existed when the debt was contracted, this would have been done as soon as silver was the least bit lower than gold, and the consequent use of silver would have prevented its fall. The argument, so far as the case of creditor *vs.* debtor is concerned, may be considered about even. The creditor is always trying to induce the government to adopt a policy (i.e., to try experiments) which will increase the burden of existing obligations; and when any attempt is made to force the government to give up such a policy once adopted, the creditor indulges in much loud talk about the danger of experimenting with the currency, and interfering with vested interests, and frightening away capital, etc. The debtor takes the opposite ground exactly; and one may be set over against the other with the remark that the money-lending class has never been so distinguished for truth-loving or disinterestedness, that we are justified in accepting their statement of the case to the extent which is characteristic of our industrial society.

3. Looking at the question from the stand-point of the permanent interest of society as distinguished from the immediate relation of debtor and creditor, it is certainly not by any means proven that we have yet reached such a stage of economic development as would enable us to get along with gold alone in our currency. A persistent and continued fall in prices is the same disturbing influence in our social and industrial economy, whether it come from a scarcity of gold or a contraction of credit; to which latter cause some monometallists ascribe the late fall in prices. The attempt is made to cast a slur upon the 'silverites' by calling them inflationists, as if to be an inflationist were the greatest of monetary sins. It would seem to be a sin of the same kind, and of even greater magnitude, to be a contractionist, since a policy of slow contraction in the world's currency is certainly productive of far more harm to the world's economy than the process of slow inflation which might occur under the action of a so-called double standard.

It is agreed by most economists that the ideal money will be stable in value. Many economists think that by a double standard a greater fixity of value may be attained than by a single standard. The fluctuations may be more numerous, but will

not be so great. All agree that we have not yet found an ideal standard in this respect. Every material which has ever been adopted as money varies in value continually, either falling or rising, and thus causing a consequent shifting of property from the hands of one class to another, and practically producing the same results as a contraction or inflation of the money-supply. We must choose, then, between an appreciating or depreciating standard, between a policy of contraction or one of inflation. This is purely a practical question, and is one mainly of degree. A high degree of inflation may be more injurious than a low degree of contraction. But as between a ten per cent contraction, for instance, and a ten per cent inflation, of the world's metallic currency at the present time, I have no hesitation in giving it as my opinion that the former would be of enormously greater damage to our modern society than the latter. This is, of course, a very different question from that involved in the contraction or inflation of the paper currency of a single country.

A system of contraction, an appreciating world currency, means, under ordinary circumstances, a world-wide industrial depression. It means an increasing burden of debt, "the cherishing of a fortune made at the expense of a fortune making," the encouragement of the non-productive at the expense of the productive classes, the injuring of those who live by current labor for the benefit of those living on past labor, the giving to the past a firm grip on the throat of the present; it means, in a word, stagnation of business, idleness and poverty, to the full extent of the influence of changes in the currency on trade and industry.

4. It is claimed that such an inflation of the currency as would result from a return to the double standard would injure the wage-receiving class. There is little doubt that the laborers would be among the last classes in the community to adapt themselves to the inevitable change incident to an inflation of the currency. Wages would be among the last things to rise. Still there are worse things than a failure of wages to rise correspondingly to rise in cost of living; as, for instance, falling wages, and diminishing opportunity to receive any wages at all, which has been rather a characteristic of the last dozen years the world over.

5. It is sometimes said, that, if we are to go back to a double standard, we should at least take the market ratio now prevailing, and increase the amount of the silver in the dollar proportionally. This would not be advisable, for the simple fact that it is highly probable that much of the present depreciation of silver, if we allow that it has depreciated at all, is owing to the fact that it has been discarded from the circulation. Restoring it to its old place by the side of gold will tend to restore its value, and to adopt the ratio now prevailing would be likely to prove a gross mistake. Neither a due respect for pecuniary obligations, nor a proper regard for the facts of history, would allow any such compromise.

6. Finally, we may say that the whole question is discussed too much from the supposed immediate effect of a restoration of silver, and not enough from its permanent tendencies. It is claimed that a return to a double standard will end in a commercial crisis, in which values will be enormously disturbed, and the whole industrial world will be thrown into confusion. Even if this be granted, it does not by any means prove that we should not return to the old system, since the evil effects of continuing the present policy may be infinitely greater. Stagnation of business, increase of burdens on the productive classes, by a continued appreciation of debts, are likely to prove more ruinous by far to national welfare than the speculation, disturbance of value, and scaling of debts, incident to the comparatively slight inflation which would follow a restoration of the silver standard, even at the old ratio, provided it were general.

E. J. JAMES.

III.

1. IT was supposed by many people that the act of Feb. 28, 1878, by the terms of which the present coinage of silver dollars is continued, would keep up the price of silver, which by that year had fallen from the old and normal price of about 60d. per ounce (English standard, 37-40 fine) to 52 9-16d., indicating a change in the ratio of gold to silver from about 1:15.5 to 1:17.92. Of course, the Bland bill was not passed solely by congressmen who had this opinion,[1] since it was also advocated by inflationists and silver-owners. But I propose to address those who, without any improper or pecuniary interest involved, believe that the use of silver on a large scale by the United States is desirable. These are honest people, and deserve something else than invective. They believed that the action of the United States would aid somewhat in restoring the value of silver, and they felt, and still feel, that the disuse of silver was a great calamity to the vast world of industry here and abroad.

Now, what has been the effect on the value of silver, of the coinage of $24,000,000 a year by the United States since 1878? Has it raised the value of silver? No, not in the least. On the contrary,

[1] I have given somewhat fully the reasons which brought about the passage of this act, in my History of bimetallism in the United States, chap. xiii.

silver has continued to fall in price since our legislation, until it is now permanently selling at as low a price as has ever been recorded, even in the exceptional period of July, 1876. The lowest point ever reached in the silver panic of 1876 for a few days was 46 3-4d. per ounce; but since September, 1885, it has steadily remained about or a little below that point. In other words, silver has fallen about eleven per cent more since the act of 1878 was passed. The supposed effect of that legislation, then, has never been produced, and the act ought not to be retained on the ground that the coinage of $24,000,000 a year can prevent the decline in the value of silver.

2. It will be said, however, by some, that this decline in the price of silver is a decline relatively to gold alone, and that since the values of articles other than silver have also fallen, relatively to gold, since 1873, we must declare that the value of gold has increased, and that the value of silver has not fallen. Now, no one can deny, that, when gold prices fall, the value of gold is increased: that has happened even when the supply of gold was rapidly increasing, as in the panic year of 1857. But I cannot think that there is any evidence to show that the fall of prices since 1873 has been due to the scarcity of gold, as has been asserted. If gold has greater purchasing-power owing to a fall of prices, that does not necessarily imply any conclusion whatever as to the scarcity of gold for the uses of trade. To say that, because prices rise or fall, there is a greater or less quantity of metallic money capable of being used, is, in my opinion, to commit a grave economic error. It certainly overlooks the practical business habits of the commercial world. While impossible to offer full reasons in so brief a paper in favor of my position, I can at least outline my ideas in a general way.

3. Prices at any given time are quite as much the result of credit as of the quantity of metallic money. As J. S. Mill said, "In a state of commerce in which much credit is habitually given, general prices at any moment depend much more upon the state of credit than upon the quantity of money." When credit in its various forms is expanded in a time of commercial activity just preceding a crisis, we all know to what great heights the prices of almost all articles can be carried. Purchasing-power in any form, whether money or credit, is used to buy goods, and is not caused by the existence of a few speculators, but by the state of mind throughout the community. And we know also, that, when the crisis comes, prices fall irrespective of the quantity of money. Of such changes, however, an objector might say that they are temporary, while the fall of prices since 1873 has been so prolonged that it cannot be due to temporary causes. But varieties of credit-devices, by which goods are exchanged against each other without the use of metallic (or even paper) money, continue in permanent use. I can only mention one of these by way of illustration, — the check system. Receiving $10,000 in money, as a manufacturer of cotton goods, I deposit it to my order in a bank. When I want to pay B for raw cotton, I send him a check for $10,000. B now owns the right to draw the deposit, and he pays C by a check for $10,000 for machinery; and D and E follow the same method of payment. During this procedure no money has been drawn, but the deposit served as the basis for transactions to the amount of, perhaps, $50,000 or more. The check, as a credit-device, was purchasing-power, and, when offered for goods, affected prices as much as the offer of gold would have done; and, as transactions increase with the growth of wealth and population, goods are exchanged for each other without the use of money by such devices as the check and clearing-house system, through the aid of banks, to a surprising amount. In New York alone, goods are exchanged for each other annually through the clearing-house, of a value much greater than that of the whole national debt of the United States (the sum exclusive of clearing-house balances, which are paid in money), without the use of a single cent of money, either gold, silver, or paper. This shows, briefly, how absurd it is to suppose that the amount of gold ought to increase in proportion to the increase of population or wealth: for in prosperous years the clearings increase; that is, the more the goods to be exchanged, the more the system is used. I cannot have space in this paper to discuss this in full, nor refer to the prevalence of the system on the continent of Europe.

What I wish to illustrate is, that the level of prices depends, not solely on the quantity of money, nor on credit, but on both combined, and that a change in prices does not imply a change in the quantity of money. I have referred only to checks. There are many other forms of credit in constant and general use, such as bills of exchange, paper money, and book credit (or 'trust,' as it is sometimes called in retail buying), and all have a great influence on prices. If prices fall, that single phenomenon, therefore, does not convince me that gold is scarce; and I do not see how it can convince anyone else.

4. There is good evidence, moreover, to show, that, in the period when it was claimed that gold was appreciating because of its scarcity, there was no lack whatever of gold. This is to be found in the rate of discount at the Bank of Eng-

land and at the great banks of the continent. As every banker knows, whenever there is an evident disposition to draw gold from the bank reserves of Europe, the withdrawals of specie lower the proportion of the reserves to the immediate liabilities (which are, except at the Bank of France, chiefly deposits). This alteration requires such an increase in the rate of discount as will ward off some of the demands for new loans, and allow the stream of maturing loans to fill up the reserves. The rise in the bank-rate is an evidence of a fear that the gold reserve is too low, or may fall too low. The London financial market is the chief one of the world, and the Bank of England rate is its sensitive barometer. What were the facts? In the four years from 1874 to 1877 (inclusive), during which year silver fell so exceptionally, the rate of discount at the Bank of England averaged 3 1-8 per cent. There was no evidence whatever of a difficulty on the part of any great bank in keeping a plentiful supply of gold in its cash reserves; and yet during this time Germany was supplying herself with $400,000,000 of gold to carry out her currency reform, and France was accumulating about $180,000,000, in addition to her previous stock, in order to resume specie payments (Dec. 31, 1877).

It may be said in reply that the rate of discount does not depend on the supply of money, but on the supply of loanable funds. This, in the long-run, is true; but if, during this period, there had been any scarcity of gold, any deficiency of the quantity in comparison with the demand for it, it is inconceivable that during the process of 'grasping' for it there should have been no serious change in the rates of discount.

5. Not only does there appear to be no evidence of a scarcity of gold since 1873, as shown by the absence of any difficulty experienced by the banks in collecting and keeping sufficient reserves (while in the United States never in the history of the national banks have they held larger gold reserves than of late), but the facts of the production of gold since 1850 give every reason to suppose that there is an abundance now in existence. The facts of production may be briefly summed up as follows: —

[000,000 OMITTED.]

Period.	Gold.	Per cent.	Silver.	Per cent.
1493–1850	$3,314	43 9	$6,742	74.4
1851–1883	4,233	56.1	2,318	25.6
Total	$7,547	100.	$9,060	100.

It will appear from this that in the 33 years since 1850, and to 1884, not only was the production of gold equal to all that produced in the 358 years from the discovery of America to 1850, but it was even greater by almost a third. And it is more than probable that the existing stock[1] in 1848 was not only doubled, but one-half more than doubled. To 1840 the annual production of gold was about $14,000,000, roughly speaking; in 1841–1850, $38,000,000; while in 1881–1884 it averaged about $100,000,000. In the exceptional years between 1850 and 1860 the production was greater than it is now; but it is still two and a half times what it was in 1848.

In short, there is not the least doubt in my mind that this very abundance of gold was the cause of the fall in the value of silver. Both metals being in use for money, when the better became more plentiful, it drove the poorer out of use, — just as steel rails are driving out iron rails on our railways, — because gold is a better and more reliable tool of exchange than silver. On the ground, therefore, of a scarcity of gold, there is no reason whatever, in my opinion, why the coinage of silver should be continued. The theory that there is a vacuum created by the lack of gold, and which must be filled by the coinage of silver in order to prevent prices from falling, is certainly not tenable.

6. The fall of prices can be explained by causes wholly independent of the quantity of gold in existence, and connected with the contraction of credit, the fall of profits due to increased competition in certain branches of industry, large production, and the introduction of new processes and improved machinery; and, unless it were absolutely certain that the silver men were correct, it would be a bold and unwarranted act of theirs, on the basis of a mere fanciful supposition in regard to the dearness of gold, to experiment on the finances of a great country when a blunder might involve disaster to our whole business prosperity. To lead us to a single silver standard, on the mere theory that gold has 'gone up,' is a piece of statesmanship which should be treated with unequivocal condemnation. Even before we come to the single silver standard, the uncertainty in regard to what the future may bring forth, caused by the continued coinage of silver dollars, is injurious to all legitimate business calculations. Uncertainty and distrust destroy all initiative. The silver-money doctors are dealing with a very complicated organism, and, if their diagnosis is incorrect, persistence in their rude treatment will be of serious damage to the financial body.

J. LAURENCE LAUGHLIN.

[1] Newmarch estimates the existing stock in 1848 at $2,716,000,000 of gold, and $3,880,000,000 of silver. Such estimates, however, are only of the nature of guesses: there is nothing accurate about them.

THE SENSE OF TOUCH, AND THE TEACHING OF THE BLIND.

THE sense of touch is one of the most complex which we possess, and one not well understood. Recent physiological studies have shown its independence of others that have long been associated with it. The senses of heat, cold, pain, and touch, bear intimate relations, but nevertheless are distinct; and a more perfect knowledge of their different phases must lead to a better understanding of many peculiarities among the blind.

Professor Soret, says the *Spectator*, taking up the psychological branch of the subject, has tried to find out how far the sense of touch may be made to convey to the sightless an idea of the beautiful: for as a deaf musician may enjoy music despite his deafness, so may a blind man find pleasure in beauty of form notwithstanding his blindness. In the one case, the pleasure comes from the rhythm, or rather from sonorous vibrations in the air, produced by the playing; in the other, from the symmetry and regularity of the object handled. "When music is going on, I feel something here," said to M. Soret a deaf-mute who enjoyed operas, putting his hand on his stomach. The blind, even those born blind, as Professor Soret has ascertained by inquiries among the inmates of the blind-asylum of Lausanne, have the same love of symmetry as the deaf. The girl-embroiderers attach much importance to the perfect regularity of the designs which they are required to repeat in their work. The basket-makers insist on the willow withes they use being all straight and of the same length. Imperfections in the things they handle are, to the blind, indications of ugliness. They like evenness of surface, and regularity of shape: a cracked pot, a rough table, or a broken chair causes them positive discomfort.

But to create in the mind of a person born blind an artistic idea, involves a measure of psychological development which it is very difficult to impart, and requires from both teacher and scholar great patience and long-sustained effort. The imagination, — the faculty of representation, as it has been called, — though partly inborn, is much more the result of a long series of automatic experiments in which all the senses co-operate, mutually controlling and correcting each other. This faculty is naturally less developed with the sightless than the seeing. If even many educated people, who from their youth upwards have been reading books and seeing pictures, find it hard to realize to themselves scenes they have never beheld, how much harder must it be for the blind to identify this or that outline with beauty, or the reverse! At the sight of a picture or a design, we straightway and without effort represent to ourselves the object delineated in all its three dimensions. It never occurs to us to think that the horse, or the man, or the mountain, is nothing more than a combination of colors laid on a flat piece of canvas. The mere feeling of a picture, albeit in relief, cannot convey the same impression as an ordinary painting; for, to the blind, perspective and foreshortening must be mysteries so profound as to be hardly capable of comprehension. Nevertheless the difficulty is not insurmountable. Professor Soret mentions the case of a blind rustic, accustomed to horses, who, without help, succeeded in selecting from a number of other designs, in relief, the figure of the animal with which he was most familiar. A youth of quick apprehension, and vivid though undeveloped imaginative power, he had handled horses in his father's or his master's stable until he had mentally created an ideal horse so like the original, that he was able to recognize by his fingers its counterfeit presentment. Another boy, born blind, but thoroughly educated, was able to pick out a bird; yet he admitted, that, unless he had previously handled a stuffed specimen, he would have had great difficulty in identifying the figure, and realizing what the original was like. In other words, mere description is not enough: a blind man cannot mentally see a thing, or even recognize it when laid in a touchable form before him, unless he has first familiarized himself, by actual experience, with its outward shape.

It would thus seem that the faculty we call 'imagination' depends nearly altogether on the sense of sight. If we have seen a hill, we may have an idea of what a mountain is like; by seeing a lake, we get a notion of the sea: but, if we never saw either a tree or the picture of one, not all the word-painting that was ever penned would convey any true or adequate idea of an ordinary wood, much less of the wondrous beauty and bewildering grandeur of a tropical forest. We should be so far blind; and the blind can image to themselves only that which they can feel with their hands. All the same, thanks to their innate love of rhythm and regularity, they can be taught, through the sense of touch, to appreciate shapeliness, to find an aesthetic pleasure in sculptures, in certain of the decorative arts, and in raised pictures. They may even learn not only to recognize their friends by feeling their features, but to single out a pretty woman and a handsome man. As to this, Professor Soret relates an amusing and suggestive anecdote. Some time ago, three professors made a visit to the Lausanne asylum. One was a stalwart and handsome Swede, with a

splendid head; the second, an exceptionally ugly Swiss, with a head 'that left a good deal to be desired;' the third, an average mortal of ordinary appearance. Among the inmates of the asylum was a poor deaf-mute of the name of Meystre, blind from his birth, but highly impressionable, and quick to distinguish between shapes that conformed to his ideal of the beautiful and those that did not. The feeling of a deformed or mutilated man, for instance, would sometimes draw from him signs of compassion and sympathy; at others, strange grimaces and mocking laughter. On being told to examine the three visitors, Meystre showed great admiration for the Swede; but, on passing to the Swiss, he seemed greatly amused, indulged in his usual mocking laughter, and by his gestures made it understood that he thought the man had no back to his head, which he seemed to consider an excellent joke. The result of the third examination was negative. It produced no sign either of satisfaction or displeasure.

These facts seem to show, and in Professor Soret's opinion prove beyond a doubt, that, so far as the 'human form divine' is concerned, the blind possess the same ideal of beauty as those who see, and that this ideal is innate; and he is anxious that those who have charge of the sightless should make every effort to cultivate their aesthetic taste; that by means of cardboard models in relief, and other expedients, they should be familiarized with the highest types of human beauty, which occupy so large a place in all literatures. By this widening of their conceptions, they would be enabled to understand allusions and descriptions in poetry and elsewhere, which at present they must find utterly incomprehensible. The better to accomplish this object, Professor Soret has drawn up a complete programme; and seeing how hard life is for the blind, and from how many pleasures they are debarred, we may heartily applaud this effort to ameliorate their sufferings by opening to them new horizons, and wish it every success.

PUBLIC HEALTH IMPROVEMENT IN ENGLAND.

THE death-rate in England and Wales in 1885 again fell, says the *Lancet*, to 19.0 per 1000 of the estimated population, and excepting only the year 1881, when it was 18.9, was lower than in any previous year since civil registration came into operation in 1837. The registrar-general's quarterly return, relating to the last three months of 1885, calls attention to the fact that the death-rate in each of the five years 1881–85 was considerably lower than the rate recorded in any year prior to 1881. The mean rate in the first half of the current decennium (1881–90) did not exceed 19.3 per 1000, showing a further decline from 20.8, the mean rate in the preceding five years 1876–80; whereas, in the preceding forty years of civil registration, the mean annual death-rate was 22.3, and the lowest rate in any quinquennium was 21.4 in 1841–45. This marked reduction in the English death-rate has now been maintained for ten years, and has been much greater in the second than in the first half of that period. It cannot, in the interest of further health progress, be too constantly borne in mind that the commencement of this period of reduced death-rate was coincident with the coming into full operation of the public health acts of 1872 and 1875.

The effect of this reduced death-rate upon the numbers and longevity of the English people is phenomenal. The registrar-general points out that the reduction in the last five years implies that "more than 281,000 persons in England and Wales survived that period, whose deaths would have been recorded had the mean rate of mortality been equal to that prevailing in the ten years 1871–80," in the latter half of which period the improvement in the public health had already set in. With regard to the increased longevity of the population, Mr. Noel Humphreys, in a paper read before the Statistical society in 1883, showed that the effect of a reduction in the mean death-rate from 22.5 in 1838–54, to 20.8 in 1876–80, would be to add two years to the mean duration of life of every male, and three years and a half to that of every female born.

PROFESSOR GRABER has made an extensive series of experiments on the degree and localization of the sense of smell in insects, etc., from among the results of which the following will be found of interest (*Journ. roy. micr. soc.*). Odors are perceived by many invertebrates, such as mollusks, insects, etc., with extreme rapidity, sometimes in one-third of a second, and even through an intervening layer of water a half-millimetre in thickness. This sensitiveness is very much greater than was exhibited by the vertebrates experimented upon (reptiles, birds). Insects deprived of their antennae are still able to smell, but in varying degrees in different insects and for different odors, some fine odors being apparently perceptible only through the antennae. Perception of smell through the stigmata or respiratory organs is not rapid nor important, though such has often been maintained. In some cases the palpi of the mouth-organs are more sensitive than the antennae, and therefore the latter cannot be considered as being alone the organs of smell.

SCIENCE.

FRIDAY, MARCH 26, 1886.

COMMENT AND CRITICISM.

A REPORT FOR THE YEAR 1884 was made to the New York legislature early in 1885 by Prof. James Hall, state geologist: it was accompanied by a large preliminary geological map of the state, compiled by Mr. W. J. McGee, of the U. S. geological survey, from all available material which was of special value on account of its candid departure from the usual form of geological maps in coloring only those areas that had been pretty well studied, and leaving the rest conspicuously blank. There is no question that the publication of such a map would be an incentive to local investigation by explicitly pointing out where it is especially needed; and Professor Hall seems to have made this clear to the legislature, as it was ordered to be published by a resolution of the senate and assembly, and an appropriation was made for this purpose. But a note added to the report in November states that the governor has vetoed this item in the supply bill, and thus the appearance of the map has been indefinitely postponed, — a most regrettable piece of political economy. The same report contains a geological map of Ontario county, with accompanying text, giving a brief outline of its geological succession, by Professor J. M. Clarke. Apart from the valuable local details of stratigraphy, it excites our interest from the indication it gives of the true physical relations of some of the north and south lakes of western New York, — called the 'finger-lakes' by Chamberlin, — which the author refers to briefly as lying in separate preglacial valleys. When the ice of glacial times was breaking up in these valleys, "which had then had, no doubt, a long previous existence as valleys of water erosion," they discharged their waters into a basin where the town of Naples now stands, whence a southward overflow was found by the Conhocton River. A little distance west of Canandaigua Lake, another valley is shown on the map, now filled with alluvium, but equal in size to the average of those near by, now occupied by lakes. It would thus appear that the northern edge of the Devonian plateau of western New York is pretty well dissected by valleys of the ordinary type, in only some of which lakes are caught. The more numerous these valleys, the less aid need be called for from glacial erosion in originating them.

THE REPORT OF OBSERVATIONS of the annular eclipse of the sun, March 15–16, 1885, by Commander A. D. Brown and Ensign A. G. Winterhalter, U.S.N., has been issued as Appendix II. to the Washington observations for 1882. At least, we suppose that this appendix belongs to the volume of observations issued by the U. S. naval observatory, for it was received from the superintendent of that institution. The titlepage, however, simply states that it is 'Appendix II., 1882,' and the reader must learn from other sources to what publication it belongs. Unfortunately this omission, trivial in itself, is indicative of the character of the paper. It begins with a jerk, ends abruptly, and throughout resembles patchwork in which the pieces are fitted together with little regard for symmetry. Beginning with the preliminary circular calling for observations from volunteers in the north-west, it next describes the preparations for photographic work at Washington, and gives the number of plates exposed, with a few comments on the success attained. Then follow the contact and transit observations made at the observatory. Returning to the volunteers in the north-west, the authors give the reports in full, with two sketches showing the relative positions of the stations. The thread of the Washington narrative is then resumed (without the slightest intimation that the scene has been changed), the measurements of the photographs are given in detail, and a reproduction, by phototype process, of one of the negatives, closes the report. While the faults of arrangement are quite glaring, there are other defects which provoke criticism. Thus, two kinds of plates were used, collodion and gelatine, having different degrees of sensitiveness; but we are frankly told, though the reason therefor is not stated, that the slide was arranged for the former only, and that in consequence the latter were necessarily over-exposed. Again, the observations are only partially discussed, and we

are left in the dark as to their accuracy or utility. The reports of the volunteer observers show the lack of careful editing by the compilers. We are told at the beginning that the photographic work was undertaken at the request of Professor Newcomb, for certain investigations he was pursuing. It would have been wiser to have turned over to him at once the observations made, instead of publishing them in their present crude form. The publication is certainly not to the credit of the institution from which it proceeds. We should hardly have devoted as much space to the above report, had it not been published at a time when the status of the observatory is under discussion. If it indicates the character of the scientific work which is done by naval officers under naval management, the position of the committee of the National academy, that it would be unwise to build a new naval observatory, is amply confirmed. Contrast with this weak paper the appendix which precedes it in the same volume, — 'The orbit of Iapetus,' by Professor Hall, a model of scientific writing, — and further comment is unnecessary. The paper also emphasizes the need of a scientific head for the observatory. If under the present management such a publication is allowed to see the light, and thus make the institution the laughing-stock of the scientific world, it is time the management was changed.

THE PRIZE offered a year ago by H. H. Warner of Rochester, for 'the best three-thousand-word paper' on the brilliant sunsets of 1883–84, has lately been awarded. The judges were Professors Kirkwood of Bloomington, Ill., Harrington of Ann Arbor, Mich., and Stone of Virginia; and their opinion of the essays was so high that Mr. Warner was induced largely to increase the awards. Meteorologists will universally read with satisfaction that Kiessling of Hamburg received the first prize of two hundred dollars. Other prizes were given to J. E. Clark of York, England, H. C. Maine of Rochester, N.Y., and Rev. Sereno C. Bishop of Honolulu; the last is now well known in connection with his early observation of the new solar corona, which is now generally called after him. It is further stated in the Rochester *Democrat and chronicle*, that a 'special Warner medal of honor' will be awarded to Professor Abbe of the signal service, Professor Upton of Brown university, Prof. H. A. Hazen of the signal service, Professor Davis of Harvard college, Mr. F. Cowle of Lauriston, Tasmania, and Rev. R. Graham of Errol, Scotland. Mr. Warner's extension of his first offer of a single prize, so that there should be a more general recognition of the efforts made by a number of the competitors, is characteristic of his generosity, already well known to astronomers from his hundred-dollar prize for the discovery of new comets. It is said to be his intention to publish the sunset essays as soon as they can be put into shape for the printer.

A VERY GREAT INTEREST attaches to the brief notice of the new objectives of Dr. Carl Zeiss of Jena, by Dr. H. van Heurck, director of the botanical gardens at Antwerp. The success of Zeiss's experiments to discover a new glass which should give more perfect objectives than it is possible to make with crown and flint glass has apparently exceeded expectation, almost surpassed the highest hopes; for, according to van Heurck, the new homogeneous immersion $\frac{1}{8}$ objective, with a numerical aperture of 1.4, manufactured by Zeiss from the new glass, excels the best English lenses in the perfection of its sharp definition: "The images are of wonderful clearness, and the objective has a greater resolving power than any that we have had hitherto. With the vertical illuminator, Amphipleura argenteum is resolved into pearls, not merely at some points, but over the whole surface, and with such sharpness that they may be counted. No doubt this objective will show us, in many diatoms, details which have hitherto escaped observers. Bacteria will probably exhibit details of structure as yet unknown, and which will perhaps enable us to better differentiate the species." We have heard from other sources equal praise of the new objective, which seems to surpass the present much admired — we might almost say beloved — oil immersions, as these surpass the water immersions. It will be remembered that Professor Abbe, the son-in-law of Dr. Zeiss, pointed out, in 1878, that we could not hope for any considerable improvement in objectives until we should have some better materials than crown and flint glass. Since then the German government appropriated twenty-five thousand marks to enable Zeiss to make experiments in manufacturing new glasses suitable for lenses. All scientific men will rejoice that the experiments have had such a very successful result. We trust that the new objectives and oculars will soon be upon the market.

THE EUROPEAN COLONIES AND THEIR TRADE.

THE large commerce between Great Britain and her colonies has, especially within the last ten or fifteen years, attracted the attention of the other European countries. They have watched with covetous eyes its steady increase and the rapid growth of the English mercantile marine, and have studied the policy which has either made the colonies of England self-supporting, or, where the expenses exceeded the revenues, pay tribute to London bankers in the form of interest at high rates on colonial loans.

Attempting to follow England's example, France and Germany have founded colonies, hoping to realize from them large commercial returns. Instead of this, the commerce with the colonies they have established has been very limited, and the outlays involved have imposed a heavy burden upon the home treasury. Even Algiers, the most prosperous of the colonies established by France, has been a constant and increasing expense. The attempt to establish a French colony in Madagascar has been abandoned, while that in Tonquin has only been maintained by the constant presence of a large army. The war with China, in which France became involved through the attempt to establish this colony, has caused a great drain on France, both of men and money; and, even at the present time, there is such a constant turmoil in northern Tonquin, that further demands of credit and fresh drafts of soldiers must constantly be made. This state of affairs will probably cause the overthrow of the ministry, if not of the republic; and the ministry have sought to avert their fate by sending M. Bert, a former minister of instruction, as governor, with full power in civil and military matters. It is asserted, and the facts seem to corroborate the statement, that the expense of maintaining the colonies of France, including the support of the required armies, largely exceeds the total value of the commerce, including both imports and exports; that the death-rate is in excess of the births: and that the French population is only maintained by draining France of her most enterprising citizens. These facts have become so overwhelming, that a party has recently been formed in France, advocating the abandonment of all her foreign possessions.

Germany recently took possession of an extensive territory on the south-western coast of Africa; but a rainless climate and a barren soil have proved insurmountable obstacles even to German thrift. Another German colony has been established on the east coast, west of Zanzibar, between the second and fifth degrees of north latitude, extending westerly into the interior. Several large rivers flow through this territory, rising in the mountain-range which separates the ocean from Lake Tanganyika. In the upland country the climate is probably healthy, and the soil rich. The Germans have also a small colony at Cameroon, on the west coast, under the equator; but here the natives have opposed the settlers, and their progress consequently has been slow. Of the commerce of German colonies, however, nothing is known, as no official returns have been published.

Italy has recently established a colony at Massowah, upon the Red Sea, with the result, thus far, of an increased deficit in the treasury. The Netherlands retains a part of its possessions in Asia; Spain and Portugal, a portion of the immense territory they formerly held in Africa and in America; and Denmark, her hold upon Greenland, Iceland, and three islands in the West Indies. The cost of maintaining these domains exceeds the revenue; but the deficit is small, and fully compensated by the commercial advantages derived from them. Belgium and Austria, on the other hand, have no foreign possessions. The Kongo Free States, which had their origin in Belgium, are a private enterprise of King Leopold II., and have been supported from his private purse. The cost of their maintenance has hitherto been very heavy, and must continue to increase, until the railroad around the falls between Vivi and Stanley Pool is constructed. allowing of the creation of trade with central Africa, and the consequent tax levies to defray the expenses of the undertaking.

Russia can hardly be said to have any colonies. The vast regions in Asia which have been settled by her people, willingly or unwillingly, should be looked upon as but natural expansions of her dominions; and little is known, either of their cost to the state, or the extent of their commerce.

Austro-Hungary alone, of the European countries, remains to be considered, and that kingdom is little more than a congery of colonies. Eleven different languages are spoken within its borders, and the people of this heterogeneous empire have

no desire to colonize other regions than those taken from Turkey.

The following tables are of much interest. They show that eighty per cent of the colonial territory held by Europe belongs to Great Britain, that over eighty per cent of the entire commerce is with Great Britain, while the territory of its colonies is sixty times as large as that of Great Britain itself.

Territory.

Countries.	Surface in square kilometres.			Percentages.	
	Mother-country.	Colonies.	Total.	Moth. coun.	Col's.
England ...	312,639	20,552,574	20,865,213	1.5	98.5
Portugal ..	89,297	1,827,259	1,916,556	4.7	95.3
Netherl'ds.	32,745	1,767,748	1,800,493	1.8	98.2
France	528,393	990,825	1,519,218	34.8	65 2
Spain......	499,570	429,085	928,655	53.8	46.2
Denmark..	35,686	225,564	261,250	13.7	86.3
Total....	1,498,330	25,793,055	27,291,385	5.5	94.5

Population.

Countries.	Population in 1881.			Percentages.	
	Mother-country.	Colonies.	Total.	Moth. coun.	Col's.
England ...	35,153,780	213,918,000	249,071,000	14.1	85.9
Netherl'ds.	4,172.991	26,841,597	31,014,588	13.5	86.5
France	37.672,048	8.722,857	46,394,905	81.2	18.9
Spain......	16,350,874	8,175,467	24,526,341	66.7	33.3
Portugal...	4,160,315	3,723.967	7,884,282	52.8	47.2
Denmark..	1.969,045	127,122	2,096,167	91.8	8.2
Total....	99,479,058	261,509,010	360,988,068	27.6	72.4

Trade.

Countries.	Commerce of the mother-country.	Commerce of the colonies with the moth.-country.	Colonial commerce compared to the commerce of the mother-country in percentages.
England	17,884.275,000	4,658,950,000	26.00
France	10,636.500.000	526,400,000	4 95
Netherlands...	4,428,450,000	200,200,000	4.50
Spain....	1,371,150,000	128,800,000	9.39
Denmark......	598,950 000	22,500,000	2.46
Portugal	391,950,000	7,925,000	2.02
Total........	35,311,275,000	5,544,775,000	15.70

GARDINER G. HUBBARD.

THE U. S. GEOLOGICAL SURVEY.

As a part of the evidence before the commission considering the organization of the government scientific bureaus, there was recently presented a letter from Mr. Alexander Agassiz, in which he took occasion to censure the work of the geological survey, and to condemn to some extent its existence as a government institution.

One question raised by Mr. Agassiz is whether the work carried on by the survey should not be left to individual enterprise. In answer to this, Major Powell, in a reply addressed to the commission, calls attention to the large expenditures required for such work, and adds, that he has no knowledge of any case where private institutions, such as colleges or societies, have undertaken to do field-work in topography and geology. To some extent individuals, notably a few college professors, have made geological excursions in the field, and have accumulated valuable material.

The principal publications in this country on geology and paleontology, however, have contained the results of investigations carried on at the expense of the general or state governments; and the publication of such results, on account of the cost of the plates required, is far beyond the resources of private institutions. To show the relation between the official publications and those at private expense, Major Powell presents some figures collected from the material in the library of the geological survey. They do not represent the entire body of publication, but it is believed that they fairly give the ratio of official to private matter. These figures show 105,775 pages on general geology published by the government, to 15,139 pages published by private parties. The ratio of geological maps is about the same; and, comparing the amount of governmental with the amount of private publications in paleontology, the ratio of number of pages is 18,151 to 13,916; the number of plates being as 2,858 to 769.

The publications of the survey contain the writings of nearly all our best geologists; and it is thought by Major Powell that a wide distribution of its scientific reports, placing them at the disposal of one or two libraries in each county in the country, would tend to make the results of the investigations as available as they should be.

It has been especially fortunate for the survey that there exists in the Comstock, Eureka, and Leadville mining districts vast shafts and galleries which have allowed of an unparalleled study of problems in economic geology; and great credit is due to the survey for having taken advantage of these opportunities. As the law establishing the

survey especially requires that economic work should be done, and as the primary function of the survey is the performance of such work, it is evident that this class of investigation has been carried on strictly in obedience to the law, and in fulfilment of its purpose.

The annual output of the mines of the United States aggregates in value about $425,000,000; and, while the economic results of the survey have largely been devoted to this industry, the needs of the agricultural community have not been forgotten. At present investigations are going on of the flood-plain valleys of the great rivers, like that of the Mississippi, for the purpose of determining the conditions under which they can be redeemed; and, on the other hand, of the great arid regions, to determine by what means they may be more economically fertilized by irrigation; and, again, of the coast marshes and interior swamps, to learn the possibility of their utilization by drainage. In the prosecution of its topographical work, the survey is constructing a map of the forests of the country: and in its study of the structural geology it is revealing the conditions under which artesian wells may be discovered, and prognosticating the areas where such wells may be constructed. In the study of the interior hydrography of the country, the survey is developing the conditions under which our towns may obtain a supply of healthful water; and, in this connection, the calls upon the survey for information are many and rapidly multiplying. It is hardly necessary to add, that, in the construction of a topographic map of the United States, the people are supplied with a knowledge of the natural routes for the highways of commerce. It will thus be seen that the work of the survey has practical relations with all the industries of the people, and that it is preeminently designed to promote their welfare.

THE RAILWAY TO CENTRAL ASIA.

UNDER the direction of General Annenkoff, the Transcaspian railway has made remarkable progress. At the beginning of the present year it extended from Mikhailovsk, on the bay of the same name, to Ghiaurs, a small station some miles beyond Askabad. From thence to Merv the road-bed is finished, and the stations and bridges are constructing. It is expected that trains will run to Merv this spring, and that by midsummer the road will be completed to the Amu Daria at Charjui, a total distance of one thousand and forty-one kilometres. The harbor at Mikhailovsk is very shallow, and the deep water at Krasnovodsk is too distant; but another spot has been found, twenty-four kilometres from Mikhailovsk, where, by a moderate amount of dredging, the largest vessels of the Caspian can come up to a jetty now building. For the other end of the line, to connect with the railway, steamers of a special type are being constructed, suited to cope with the swift and shallow waters of the Amu Daria. The difficulty presented by drifting sands in the desert is to be met by introducing plants, already tested for such purposes in the arid regions of Algeria; and at the principal stations large quantities of them are already being set out in propagating-houses.

This enterprise is a military road, built and designed by officers of the war ministry, assisted by soldiers, Tartars from the Caucasus, and Turkomans and other inhabitants of the region. The chief difficulty has not been the sands of the desert, but the want of water: the existing wells being far apart, brackish, and hardly sufficient for the ordinary purposes of the caravans. However, it has been determined by experiment, that, at a certain depth in the soil, water exists in sufficient quantity, and increases at greater depths. Artesian wells will therefore be dug, the machinery for which is already on the ground. The worst part of the line determined upon is the desert which extends some two hundred kilometres eastward from the Merv oasis. This, though arid and sandy, produces a growth, sometimes almost a wood, of the 'saxaul' (Haloxylon ammodendron) and other nearly related shrubs, which only disappear at a distance of some forty kilometres from the Amu Daria.

After passing the lesser desert near Mikhailovsk, and reaching the station at Kizil Arvat, the railway takes a direction parallel to the Kopeth range, which coincides with the borders of Persia. It crosses the Akhal oasis, and passes under the walls of Geok Tepe a few yards from the spot where the assault was made by which the fortress was carried. The most important station is Askabad, a flourishing town only three years old, but already enjoying an important commerce with North Khorassan. Farther on, the line passes the Persian village of Lutfabad at a distance of two kilometres, and enters the Attek oasis, now beginning to revive under the security afforded by Russian rule. Duchak, at 391 kilometres from Kizil Arvat, is the most southern point of the line, from which diverge the routes to Séraks, Heshed, and Herat. Here the road turns toward Merv, and enters the desert in a north-westerly direction. There are no brooks or springs, but from the mountains to the south-east come two rivers of importance, — the Tajand or Hari-Rud, and the Murghab. The former is dry in winter, but in summer has twice the volume

of the Murghab. To the north-west both rivers are lost in the sands of the desert. The Hari-Rud is crossed by a bridge ninety-seven yards long. From this point it was formerly a distance of ninety kilometres to the nearest fresh water, but this has been diminished to forty-eight kilometres by a canal constructed by Colonel Alikhanoff during the past season. This diverts part of the water of the Murghab, but it was found impracticable to extend it further. The latter river, unlike the Hari-Rud, does not dry up, but carries in winter seventy-five cubic metres per second as against three hundred in summer. It contains about two per cent of earthy matter, amounting, for the annual epoch of floods, to about fifty million cubic metres of mud, which is spread by the innumerable irrigating canals over the surface of the Merv oasis. The destruction in 1784, of the great dike of Sultan Bend, much diminished the irrigated and fertile area. The Russian government has reserved sixty thousand rubles to rebuild this dike, and it is expected that nearly four hundred thousand acres will be reclaimed by this work, and, in time, nearly four times as much more. This land, when irrigated, is of extreme fertility, wheat producing a crop of one hundred bushels for every bushel sown. Merv is growing rapidly: town lots of a certain size are given away, on condition that the receiver builds upon them at once. The streets are wide, with broad footwalks, planted with trees, and bordered with small canals. The oasis is confidently expected to develop largely in the near future.

PHOTOGRAPHIC STUDY OF STELLAR SPECTRA.

THE study of stellar spectra by means of photography was one of the most important investigations undertaken by the late Prof. Henry Draper. He was actively engaged in this research during the last years of his life. His plans included an extensive investigation, one object of which was to catalogue and classify the stars by their spectra. Mrs. Draper has made provision, at the observatory of Harvard college, for continuing these researches as a memorial to her husband. The results already obtained, with the aid of an appropriation from the Bache fund, permit the form of the new investigation to be definitely stated. The part of the sky to be surveyed is that extending from the north pole to the parallel of thirty degrees south declination. Each photograph will be exposed for about one hour, and will include a region ten degrees square. The telescope employed has an aperture of twenty centimetres (eight inches), and a focal length of a hundred and seventeen centimetres (forty-four inches). The object-glass is covered by a prism, and the resulting spectrum of each star in the region photographed has a length of about one centimetre, which enables the character of the spectra of stars from the fifth to the eighth magnitude to be determined. A modification of the apparatus is employed for the brighter stars.

Meanwhile, experiments are in progress with the fifteen-inch equatorial, with the object of representing the spectra of some typical stars upon a large scale. The spectra so far obtained are about six centimetres in length, and exhibit much well-defined detail. Additional experiments will be tried with a spectroscope provided with a slit, as well as with the simple prism hitherto employed, in order to secure the best possible definition. The present results encourage the expectation that the movements of stars in the line of sight may be better determined by the photographic method than by direct observations.

To keep the astronomical public informed of the progress made in this work, specimens of the photographs obtained will be gratuitously distributed from time to time. The first of these distributions will probably be made in a few weeks. Owing to the expense of providing a large number of copies, it is desirable to limit the distribution, so far as possible, to those who are interested in this class of work. It is also desired, however, to send the specimens to all who will find them of value from the scientific point of view. Requests should be sent to the Harvard college observatory by any one desirous of receiving the specimens. EDWARD C. PICKERING.

THE HUDSON BAY ROUTE TO EUROPE.

LAST year there appeared in *Science* (vol. v. No. 110) an account of the Hudson Bay expedition of 1884, accompanied by a track-chart showing the route followed. Lieutenant Gordon's official report of his last summer's trip to the bay, to relieve the observers at the stations established in the strait in 1884, is included in the annual report of the Canadian department of marine, lately submitted to the Dominion parliament. It is in narrative form, and contains little new information, the results of the observations conducted at the several stations being reserved for publication as a separate report so soon as they shall have been reduced to proper form.

Lieutenant Gordon, after promising details of the observations at an early date, concludes his report with the following remarks on the prospects of navigating the strait: "The reports go to show that the ice set fast in the western end of

the straits during the last week of October, 1884, and that for all practical purposes of navigation the straits remained closed at this point till the early part of June in the present year. In June a good deal of open water was seen at different times, but the pack would close up again, and remain in that condition for several days at a time.

"From a consideration of these reports, I am of the opinion that it might have been possible to pass through the straits during the early part of this July. The same date of closing as shown by the observations last year would give a season of navigation rather less than four months for the individual season.

"It should, however, be stated, that the movements of ice this spring were evidently much later than those of last year; for in the month of August this year we met with vast quantities of heavy ice, and in the same month last year comparatively little was seen. On the Labrador coast and at Churchill the report was the same, — that the ice was unusually late in leaving this year.

"I was informed by a captain who had made a number of voyages through Hudson's Straits, that he had seen the straits clear of ice in June, but that it was a rare occurrence. The fact, however, that the straits had been clear at this time, shows that there is a great variability in the dates of the opening of navigation."

The above conclusions scarcely seem to justify the building of a railway from Winnipeg to Churchill, — a scheme so seriously contemplated, that one or more companies have been organized, an extensive preliminary survey made, proving the feasibility of the route, and the requisite capital actually promised; while one of the engineers has gone so far as to assert that the bay and strait were navigable for properly constructed vessels all the year round.

The observers at all the stations report that the huts were warm and comfortable, the food good and sufficient, and their health, except in the instances mentioned, excellent. The weather was not nearly so severe as expected, the thermometer never going so low as it often does in inhabited portions of the north-west.

THE PANAMA CANAL.

IT has been reported in the daily papers from time to time, during some months, that matters at the Isthmus of Panama were in a bad shape, that the funds previously subscribed and loaned were nearly exhausted, and that but a small portion of the necessary excavation had been completed. Apparently to counteract the impression made on the public mind by these statements, M. de Lesseps, on his brief visit of inspection of the work in progress on the canal, from which he has just sailed for France, was accompanied by delegates from various commercial cities of Europe and this country, and an engineer was also despatched by the French government to report upon the state of affairs, before a decision should be made in regard to the advisability of allowing a further sum of money to be raised and borrowed for the canal.

In the supplement to No. 148 of *Science* (vol. vi.) there appeared a notice of the recent book by J. C. Rodrigues, on the Panama canal, which, from his point of view, showed that the canal construction had been shamefully mismanaged from the start, and that failure and bankruptcy were imminent. There has just issued from the press another work[1] on the same subject, written by one who has had a large, if not the largest, share in the preliminary investigations, in the deliberations of the canal congress, and in obtaining the territorial and other concessions, and has had the best of opportunities for knowing about the progress of the work, — Commander Lucien N. B. Wyse. As will be inferred from the sub-title, the author aims to give an exhaustive account of the matter, from the very earliest explorations, through the discussion of the several proposed routes, a critical analysis of the points for and against the eleven most promising lines, an account of the political and business negotiations with other countries, the concessions secured, and the views and arguments of the United States authorities, down to the present state of the work (October, 1885), the money already expended and the future prospects. The admirable map which Commander Wyse gives, of that portion of Central America and the isthmus in which lie his several projected routes, is reproduced with this issue of *Science*, and the accompanying profiles show in metres the elevation of the ground over the different lines. The book contains also a plan of the Panama canal as it is to be when completed, and some ninety woodcuts of isthmian scenes and views of the canal-works.

The volume is very handsomely printed; and a person, whether interested or not in the canal, will find the opening portion, describing the scenery, the flora and fauna, the geological formations, the climate, the inhabitants, and the mode of life in that part of the world, very readable. Space will not permit the giving of an ab-

[1] *Le canal de Panama, l'isthme américain; explorations; comparaison des traces étudiés; négociations; etat des travaux.* Par LUCIEN N. B. WYSE. Paris, *Hachette*, 1886. 8°.

stract of his account of the explorations, in which many parties were occupied for a long period and over a great extent of territory. Nor can more than mention be made of the eleven plans, by different explorers, discussed in detail: viz., —

1°. By Commodore Shufeldt and Mr. Fuertes, at Tehuantepec, 280 kilometres, all to be excavated, and 140 locks.

2°. By Childs, revised by Commandant Lull and Mr. Menocal, at Nicaragua, 292 kilometres, 195 of which are to be excavated, Lake Nicaragua and 21 locks.

3°. By Commandant Lull, at Panama, 72 kilometres, all to be excavated, with 25 locks and a canal-bridge over the Chagres River.

4°. By Wyse, Reclus, and Sosa, at Panama, 75 kilometres, all to be excavated, a sea-level canal, with or without a tunnel, and now under construction.

5°. By Wyse, Reclus, and de Lépinay, at Panama, 72 kilometres, 50 of which are to be excavated, with 11 locks and an artificial lake in valleys of Chagres and Rio Grande.

6°. By McDougal, Commandant Selfridge, Wyse, Reclus, and Sosa, at San Blas, 53 kilometres, 42 of which are to be excavated, level canal with tunnel of 15 kilometres.

7°. By Wyse, etc., at Darien, 125 kilometres, 74 of which are to be excavated, level canal with tunnel of 17 kilometres.

8°. By Wyse, etc., at Darien, 235 kilometres, 128 of which are to be excavated, with 22 locks and tunnel of 2 kilometres.

9°. By Trautwine, Kennish, Michler, etc., at Choco, 210 kilometres, 90 of which are to be excavated, level canal with 2 tunnels of 3 and 8 kilometres.

10°. By Commandant Selfridge and Mr. Collins, at Choco, 290 kilometres, 50 of which are to be excavated, with 22 locks and tunnel of 6 kilometres.

11°. By the same, the same, modified to 2 locks and tunnel of 6 kilometres.

It will be interesting to see how the author's opinions of the past conduct of the work on the canal, the present material and financial condition, and the future prospects for completion, compare with the views of Mr. Rodrigues, already referred to. But in weighing the statements it will be well to bear in mind that the author has written this book, as he states in his dedicatory letter, to establish the facts for his family's sake, that he was the originator of the plans and route adopted, and the negotiator of the concessions obtained, — facts which otherwise seemed likely to be obscured by the strong personality of de Lesseps. He desires also, by presenting his original plans, to absolve himself from blame for errors committed by others. He acknowledges that between the session of the Paris congress in 1879, and the organization of the canal company in 1880, a coldness sprang up between M. de Lesseps and himself, and that his appointment as director-general was withdrawn.

He states, that, in order to have some official acquainted with the business in hand, the place of superior agent at the isthmus, with duties but poorly defined, was given to his old friend and collaborator, M. Reclus, who initiated the enterprise in January, 1881, began the clearing, the final studies, the assembling of plant, buildings, etc., built a large landing at the north entrance, and erected a general hospital at Panama. He was succeeded in June, 1882, by M. Verbrugghe, and later by M. Richier, under whom was begun the first digging of the canal proper. This administration was not a success; and when, in 1883, M. Dingler was appointed director, he abolished the office of superior agent. The oversight of the work, already too negligent, became quite inefficient; and to-day, four years and a half from the beginning, matters are in a bad shape. The appointment of Engineer Hutin, first as subdirector and then as chief engineer, is not sufficient, despite the good-will which he brings to his position, to remedy the evil already done.

In October, 1885, the following was the state of affairs: there has been moved a total of from sixteen to seventeen million cubic metres of earth, twelve millions only being from the canal proper, and eighty-eight millions are still to be excavated. Besides, there have been prepared buildings and stables on an extravagant scale, farms and gardens at great expense around headquarters, railroad branches, field hospitals, and roads, three of which he says are of but little use except for pleasure-riding by idle employees. Considerable labor has been expended on the Atlantic side. The best organized works are at Emperador; while at Culebra, a very important section, as will be seen by the profile, the reverse is the fact, and the amount already excavated is far out of proportion with the vast quantity which yet remains in place. On the Pacific slope the work is less advanced. He claims that at Culebra, by an injudicious deviation from his line, the management has increased the depth of cut from eighty metres to a hundred and nine metres. A vast quantity of tools, machinery, and materials, has been collected, and some fine workshops have been organized. Many of the excavators and dredges have caused trouble, delays, and breakdowns, while difficulties with the temporary tracks and cars for moving earth are frequent. The question of the protection of the canal from the dangerous floods of the Chagres River by means of a dam and large storage-reservoir has not been settled in the last three years. What he thinks of the present management may be inferred from his expression, *une administration méticuleusement paperassière.*

The company has received half of its capital stock, a hundred and fifty million francs, besides four hundred million, in round numbers, in obligations of three different types. It has on hand

something over sixty million francs, and the remaining half of its capital, with which to pay for the excavation of eighty-eight million cubic metres. From eighteen months to two years have been lost through lack of discipline and ill-directed efforts. If we judged only from the earth already moved, there would be required to complete the work four thousand million francs and thirty-six years. But the expense and time spent in getting ready, the acquisition of property, and the collection of materials, must be considered. There have been wasted in useless works, too high prices, and absurd contracts, a hundred and fifty million francs. The errors committed by the direction will amount, at the time of completion, to a loss of about three hundred and fifty million francs, to which ought to be added a large share of the ninety-four million francs paid for the Panama railroad, since the better terms he had negotiated with the railroad company were set aside.

He still adheres to and defends his original estimate of a hundred and five million cubic metres of earth as the quantity needful to be moved, provided the useless plans for the deviation of the Chagres, and the formation of a great interior port near Corrozal, are given up. The treatment he would apply to the river is that of one large dam and a number of smaller ones along its course. The earth has proved of good quality for retaining a slope, is deeper, and there is less rock and of a less hard nature than was anticipated. By a reformation of methods of administration and work, by the employment of experienced contractors, by carrying out no unnecessary projects, by push and energy, he estimates that it is possible to finish the canal in six years. The company must raise, for the eighty-eight million cubic metres of excavation, at five and a half francs per metre, four hundred and eighty-four million francs, and seventy-five millions for accessory works, and one hundred millions for discount, interest, etc., less certain savings which can be made; in all, about six hundred million francs. By proper and rigorous economy he believes that the total cost can be brought to twelve hundred million francs.

We find, further, that he calls attention anew to his alternative project at Panama, with ten or eleven locks, the fifth in the preceding enumeration, as offering a cheaper and a quicker solution of the problem in which the company is now engaged. Current rumor would seem to indicate that the company was leaning towards such a way of extricating itself from its present difficulties, even with an abandonment of the chief argument in favor of the Panama route, — that it would be a sea-level canal like the Suez canal, without locks.

He closes with a discussion of the mercantile advantages to be derived from the canal, and the revenue from which to repay the great outlay cited above.

LONDON LETTER.

IN the first of this series of letters, allusion was made to the frightfully unsanitary condition of the river Lea, in one of the London suburbs. From the upper part of this, water is still drawn for the metropolitan supply, while enormous quantities of sewage, etc., are allowed to drain into it lower down in its course. A few days ago a public meeting was held at the Mansion house, London, under the presidency of the lord mayor, in aid of the "National society to secure effective legislation against river-pollution." The attorney-general, Sir C. Russell, M.P., moved the following resolution: "That the speedy purification of our rivers would, in the opinion of this meeting, effect a great reform long urgently needed, and of vital importance to the general health and welfare of the community." There were two defects in the existing law: first, it was only permissive instead of compulsory; second, its powers could only be put in force by the sanitary authorities, who in some instances had been the main offenders. He would like to see the law so amended that no sewage-pollution should be allowed, under any circumstances, to enter any river, — at least, up to the point of its reaching the sea or a great estuary, — and he did not think the difficulty of making the law effective to that extent would prove very serious. Reform in the case of the river Lea would be a pioneer of reform in the case of other rivers; and, if the responsibility of dealing with sewage were placed on communities, the question would very soon be settled. From what came under the notice of the present writer during his recent visits to America, he thinks these weighty words should not be without due warning to various parts of the states and Canada.

The exceptional length and severity of the present winter are universal topics of conversation. For some days there has been skating in the London parks, — an event without precedent, for the second week in March. On the nights of Saturday and Sunday, March 6 and 7, the minimum temperature registered by screened thermometers (verified at Kew) near Stoke-on-Trent, in the midland districts of England, was 7° F. The next lowest temperature recorded in March was 13°, on March 13, 1845; and, according to Mr. Glaisher's Greenwich tables, that was the coldest

day for the sixty years from 1814 to 1873. Over the greater part of the British Islands, this February was one of the coldest Februarys on record: the Greenwich mean being 33°.8, or 6°.8 below the average, while through Great Britain generally, from the Grampians to the Channel, the mean temperatures were from 5° to 7° below the monthly averages. Severe snow-storms blocked the lines on the east coast in the first few days of March, and also in North Wales, as many as thirty trains being snowed up between Newcastle and Berwick alone.

It has long been observed, that, for every degree below the average temperature in any week, a definite increase takes place in the average number of deaths, chiefly among elderly people. Among recent victims, two may be mentioned, — the famous Scotch naturalist, Mr. C. W. Peach, who was a most remarkable example of the irrepressible instinct of a true lover of nature; and Dr. Storrar, for many years chairman of convocation of the University of London. To him the medical graduates of that university owe far more than most of them are aware of. In the early days of the university, nearly half a century ago, its degrees were, for various reasons, looked on with much suspicion, and the other medical bodies in authority were inclined to deny any status whatever to the new graduates; in fact, attempts were made to prevent them from engaging in ordinary medical practice. Dr. Storrar sacrificed his own professional prospects in order to fight this question, and at the present day the London university degrees in medicine rank as the highest which it is possible to obtain.

The engineering tripos at Cambridge, alluded to in a former letter, has now been fairly established, and the chief regulations in connection therewith appeared in the university intelligence of the *Times* a few days ago. Inquiries as to the desirability of establishing degrees in engineering have been issued on behalf of the University of London.

The annual report of the director of the French agricultural department on the proceedings of the Phylloxera commission has just been published. It has been decided that none of the processes made known during the year 1885 entitle the inventors to the prize offered by the government, and accordingly the old remedies continue to be recommended. These are, 1°, submersion, which was applied in 1885 to 24,339 hectares; 2°, carbon disulphide, to 40,585; and, 3°, potassium sulphocarbonate, to 5,227. American vines which have been planted now replace those destroyed, over a surface of 72,362 hectares. The surface which has resisted the attacks of the insect is about twenty-two per cent of the whole surface suffering from the disease.

The hydrophobia scare is still sufficient to keep the muzzles on the unfortunate dogs. Questioned last night in the house of commons by Sir Henry Roscoe on the subject of M. Pasteur's cure for this terrible disease, Mr. Chamberlain replied, on behalf of the government, that he hoped to be able to arrange for such an investigation as would enable a just estimate to be formed of M. Pasteur's method, and its applicability in this country. In a recent paper read before the French academy of medicine, M. Pasteur gave details of three hundred and fifty cases, all of which, with one exception, he had treated successfully; and he has, whenever possible, secured certificates from doctors and veterinary surgeons as to the existence of rabies in the animals concerned. M. Pasteur hopes soon to turn his attention to diphtheria.

W.

London, March 18.

VIENNA LETTER.

THE struggle between gas and electricity as means of lighting has reached a new stage in the invention of Dr. Auer of Welsbach, Austria, a young Vienna chemist who has been experimenting at Professor Lieben's laboratory. The principle of Dr. Auer's invention is no new one. Every one knows the Drummond light, in which a cylinder of lime is brought to incandescence by a burning mixture of hydrogen and oxygen. But, in all previous attempts of this kind, a temperature was required too high for ordinary use. Dr. Auer has found a substance — the composition of which he unfortunately keeps a secret — which becomes incandescent at the temperature of a Bunsen burner. His lamp consists of such a burner, surrounded by a common lamp-cylinder, in the flame of which is hung a hollow cylinder of thin 'organtine' impregnated with a metallic salt solution. By the action of the flame, the organic matter of the 'organtine' is destroyed; the salt is converted into an oxide; and a white, very elastic, porous cylinder remains, which becomes incandescent. Dr. Auer's lamp has given, according to recent measurements, a luminous power of twenty candles at a gas-supply of fifty-six litres per hour.

A very important discovery, both for practical and theoretical medicine, has been made here by Mr. Ernst Freund, a pupil of Prof. E. Ludwig, at Professor Stricker's laboratory. From earlier experiments, it is known that blood does not coagulate so long as it is contained within the living healthy vessels; though clotting occurs whenever the vessels are injured, or have lost their vitality,

according to experiments made by Durante and by Zahn. In a short time (in man in three minutes) after the blood is withdrawn from the veins, or after death, coagulation of the blood commences. Coagulation can be hindered or suspended in various ways, such as contact with living healthy vessels (Lister, Bruecke), exposure to low temperature (at 0° C.), or by the addition of solutions of certain neutral salts (sodium chloride, sulphate, carbonate; magnesium sulphate, etc.). If peptone is mixed with the blood, its clotting is suspended; and Dr. Haycraft of Edinburgh has kept it fluid for a longer time by adding an aqueous extract prepared from the intestines of leeches. It may be also noted that a German physiologist, Professor Gruenhagen, some time ago observed that blood, if collected in glycerine, remained fluid so long as a mixture did not take place.

Now, Mr. Freund has found a very simple method to prevent the coagulation. He collected the blood, drawn from the vein of an animal, under oil, and it remained fluid for many days. In further experiments it was found, that, in arterial blood collected in a glass vessel whose walls were continuously coated with a film of vaseline, the fibrine did not separate, even when stirred or agitated with a vaseline-coated glass rod; but, as soon as the blood was poured into an ordinary receptacle, the fibrine was immediately coagulated. It was further observed by Freund that the presence of minute foreign bodies, such as particles of dust, was sufficient to produce clotting. These experiments were made, both at ordinary temperatures and at that of the body, with equal success. In one of the experiments which I had the opportunity of seeing, a glass tube coated with oil was inserted into the carotid artery of a dog, while a dry tube was connected with the crural artery of the same animal. The blood in the latter was clotted in fifteen minutes; but the pulsations of the blood column in the oiled tube were perceptible for more than two hours and a half. Fresh blood contained in fish-bladders, or parchment tubes, which had been previously soaked in a 0.6 per cent solution of chloride of sodium, and afterwards covered with a like solution, remained fluid for many days.

Mr. Freund has made a preliminary communication on his researches, which will be continued in an early number of the *Wiener medicinische jahrbücher*. V. C.

Vienna, Feb. 16.

NOTES AND NEWS.

THE teachers' course in chemistry at Harvard during the summer of 1886 will be under the direction of Dr. Comey, and will open July 5, and close Aug. 14. Instruction will be given in general chemistry, qualitative analysis, quantitative analysis, and organic chemistry. A course in mineralogy will also be given. The fee for the course is twenty-five dollars. An additional charge, which has averaged from five to six dollars, is made for the material and apparatus consumed by each student. The summer classes are offered the same facilities for laboratory work as are open to students during the academic year. The college library is open for the use of students in these courses. For further information address Arthur M. Comey, Harvard chemical laboratory, Cambridge, Mass.

— On the 23d of September, 1882, Friedrich Wöhler died, in his eighty-third year, one of the last and one of the most eminent of the chemists whose lives and labors connected the early formative age of the science with that of its recent wide expansion. As investigator and teacher, as author and scientific correspondent, he deserved, as few have done of those who have passed away in our time, that his memory be held in honor by those who care for the science of chemistry. Soon after his death a movement was begun in Germany, originating with the German chemical society, for the collection of an adequate sum of money with which to erect in Göttingen a statue to Wöhler, as a permanent monument, on the spot where most of his life's work was done. The subscription has reached the sum of about four thousand dollars, but this is not yet sufficient for the purpose in view. The co-operation of American chemists has recently been asked by a member of the local committee in Göttingen, in a letter addressed to one of the undersigned, who have formed a committee for the United States in order to give practical shape to action in this country. Contributions may be sent to any one of the following: James C. Booth, U. S. mint, Philadelphia: J. W. Mallet (chairman), University of Virginia: C. F. Chandler, Columbia college, New York: H. B. Nason, Rensselaer polytechnic institute, Troy; F. Frerichs, Mallinckrodt chemical works, St. Louis; Ira Remsen (secretary and treasurer), Johns Hopkins university; Wolcott Gibbs, Cambridge; W. B. Rising, University of California, Berkeley; E.P. Harris, Amherst, Mass.; S. P. Sadtler, University of Pennsylvania, Philadelphia; J. W. Langley, Ann Arbor; C. U. Shepard, jun., Charleston, S.C.; F. Mahla, corner 21st Street and Stewart Avenue, Chicago; Eugene A. Smith, University of Alabama, Tuscaloosa.

— Four additional sheets of the New Jersey topographical map are lately issued, making ten

now published out of the total seventeen. The unfinished sheets cover the inland area of the state, along the lower Delaware. The arrangement of the map sheets was illustrated in *Science* (vii. No. 155). A map of the whole state, five inches to a mile, will form an eighteenth sheet.

— The fifth annual report of the U. S. geological survey, just issued, contains a number of valuable works by well-known authors, and is richly illustrated by excellent engravings. In addition to the papers already noticed, there is one by Prof. O. C. Marsh, on the gigantic mammals of the order Dinocerata, — an abstract of his volume on the same subject, already published, — and one by R. D. Irving, entitled "Preliminary paper on an investigation of the archaean formation of the north-western states," which contains the results of field and laboratory investigation of the problems of correlation, structure, and genesis.

— Professor Koch of Berlin is issuing a *Zeitschrift für hygiene*, for the publication of his own researches, which have hitherto been made public in the official documents of the imperial health office, as well as for the publication of the results of investigations undertaken under his direction in the Hygienic institute lately established in connection with the university.

— After many denials, it is again authoritatively announced that Professor Du Bois-Reymond is at work on a history of natural science in the nineteenth century.

— The strips of papyrus that were taken from an Egyptian excavation several years ago, and placed in the Berlin museum, are said to contain parts of the great work of Aristotle on administration, and, in particular, passages from the most valuable part of that work, — that treating of the civil administration of Athens.

— J. H. Darwin, son of the late Charles Darwin, is understood to have his father's biography nearly ready for publication. It is believed that the book will contain much of interest concerning the naturalist's domestic life, and his methods of carrying on his investigations and researches.

— At the last meeting of the Academy of political science, Columbia college, Hon. John Jay Knox, ex-comptroller of the treasury, read a valuable paper on 'Legal tender in the United States.' It is not improbable that Mr. Knox's paper will be published in an early number of the new *Political science quarterly*.

— The annual report of the Connecticut agricultural experiment-station, for 1885, deals almost wholly with analyses of feeding-stuffs and fertilizers. The laws of Connecticut require analyses to be made of all commercial fertilizers annually. The results of such, accomplished at this station in past years, have been of real value to the farmers and gardeners throughout the state. The larger part of the matter upon food-stuffs is compiled, though evidently useful. The original portion, however, is not inconsiderable. In these reports one is impressed with the almost purely chemical nature of the work accomplished; and the *personnel* of the station is composed wholly of chemists. While there can be no question of the great importance of agricultural chemistry, it certainly seems that the work of an agricultural experiment-station should not be so exclusively limited. One must think that a botanist and entomologist would be a desirable accession to the already able staff.

— Messrs. Romanoffski and Mushketoff have published a geological map of Russian Turkestan in six sheets, on a scale of 1 : 1,260,000. Besides surface geology, this chart shows the area occupied by ancient and modern glaciers, the location of mines, and the altitude of all important points.

— There have been received to date at this office the following subscriptions to the Heer memorial: Prof. Jules Marcou, five dollars; Prof. Asa Gray, five dollars; Mr. S. H. Scudder, five dollars.

— The next annual session of the National academy of sciences will be held in Washington, at the national museum, commencing Tuesday, April 20, at 11 A.M.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Certain questions relating to national endowment of research in this country, and their importance.

We have before us for our consideration at the present time, in this country, a number of questions of the highest import to science, of which it may be said that they are as yet in a formative stage. By this is meant, that the United States, as now representing one of the distinct nations of the world, has not yet expressed a national opinion upon them, after the manner usually adopted by nations for expressing opinions which may be said to be national, and which the nation stands willing to defend in opposition to the opinions of other peoples. Of the several questions that I refer to, none can claim greater weight than that one which takes into consideration the extent to which our government should endow scientific research.

This is really a point in political economy of the utmost importance, as it affects the national welfare, and has much to do with the formation of the national character. To those who have watched the growth, and approach towards a decision, of this issue during the past twenty-five years, the fact

must now be evident that we have arrived at that point when we must soon decide upon the attitude we are to assume in regard to it.

When all the elements of civilization have been in operation for over a century in a new country like ours, and when we come to study the final result, there is no better criterion of the success of that civilization than the relative number and the eminence of the leaders in the sciences, arts, and industries that it has produced.

We have many such leaders, and they must be regarded as the best fruits of our civilization; while their works, or the effects of their works, will always measure the degree of respect that we are held in by other nations.

To-day the problem which is contained in that chapter of political economy which deals with the question of the nation's placing to the best use these fruits of her civilization, is one of the highest importance, and is yet to be rigidly applied, for it is still tossed upon the waves of varying opinion created in the minds of men.

During the various stages of development of this principle in our country, the government at different times, and under different influences, has assumed an attitude towards it varying all the way from open hostility to the very verge of that method of treatment employed by King Frederick of Denmark, in the case of Tycho Brahe, three hundred years ago.

Aside from our great problems of education, there stands the equally vital question to us, which may be expressed in its broadest sense as the question of national endowment of research. This is one that naturally resolves itself into two general phases, which are quite distinct. The first is, taken in the light of a productive expenditure, to what extent should the government assist scientific researchers in private life; and, secondly, to what extent should she encourage it among those directly in the government employ.

Touching the first of these questions, I shall have but little to say; and such as it is, is mainly prompted by the aims and purposes of that act which has just passed the senate, known as the 'Blair educational bill.' This provides that the enormous sum of seventy-nine million dollars of money be appropriated from the national treasury for distribution among the states and territories "in that proportion which the whole number of persons in each, who, being of the age of ten years and over, cannot write, bears to the whole number of such persons in the United States." Now, this step not only presupposes that this country claims the right of voting away public means to such ends, but that she actually intends to act upon that supposition. In my own opinion, the nation does hold just such a right; but as well-meaning as the purposes of this bill are, in view of the excellent school advantages all over this country for all classes and conditions, would not the state be equally well served, if not better, by the treasury appropriating a similar sum to be used, by methods now well known to us, towards the development of an American Pasteur, or a Priestley, or another Agassiz, a Longfellow or a Fulton? Has any one any doubt as to which appropriation would advance the national and the people's interest the more? I believe the ends of all education are best met by the latter means of expenditure and endowment. I stand on the side of the king of Denmark, in his principle as applied to Tycho Brahe.

In taking up the remaining side of the question, — i.e., the extent to which the government should recognize and further the researches of those persons in her employ who have from time to time demonstrated their peculiar fitness to perform certain work, — I will, before discussing the subject, formulate a few well-known and established principles. These are as follows: —

1°. Both present and past history teaches us, that, in those rare instances where persons of high attainments, or even genius, have been enabled through government endowment to devote all their energies to their special line of investigation, the result has been of incalculable benefit to mankind for all time.

2°. That one of the inherent characteristics of the pursuit of knowledge is its inability to maintain itself commercially, and that, in all cases wherein the researcher is not financially provided for, it must of necessity be linked with some other occupation.

3°. That the published results of the labors of investigators are only of the highest standard and worth when the investigator has been enabled to pursue his researches with a mind absolutely relieved from pecuniary worry, and an absolute assurance of his being undisturbed, in any way, in the field of his investigations.

4°. That, to make actual progress in learning, the investigator must have the means at his disposal of thoroughly acquainting himself with every thing that has been previously made known by former workers through their published results; then any new facts he contributes in his special calling may be considered as contributions to knowledge.

Aided by these principles, let us now see what the government can effect with her bibliographers who are upon lighthouse duty, anatomists in recruiting officers, bacteriologists in charge of the library, pathologists as ordnance officers, and geologists in charge of the hospitals. There is no question but that the government possesses both the right and the power to apply any one of these distinguished gentlemen to demonstrate the first principle; and will any one question the gain that would follow, to knowledge, humanity, and the nation, by removing the bacteriologist from the library and placing him in the laboratory, where perhaps several thousand dollars' worth of instruments may be awaiting him?

The position of the majority of such scientists in the services fulfils the second principle; and, in any event, the government would have no trouble on that score, as she can retain in her service anyone as long as they please to remain.

It is equally evident that both of the last principles can be carried out by the government with the greatest ease, and without any additional outlay. The pay of any government officer is always sufficient to support him; and we all know that the government lacks neither opportunity, libraries, material, or the power of lifting from off the shoulders of her scientific workers all but the most necessary restraints. Of course, beyond the opportunities afforded by the national libraries, the fulfilment of the fourth principle remains entirely with the scientist himself.

Now, these exceedingly simple requirements are all that is necessary for this government to put into execution, in order to carry out and place in operation the grandest of all social schemes, the most powerful impulse to the progress of knowledge, and

the most complete realization of the ends of all education; yet how rarely is a step ever taken in the direction of putting into execution these four principles, and how often are they violated entirely!

Even to-day, as in years gone by, we find the scientist placed in charge of hospitals full of sick men, and with the lives of women and children in his hands besides, when he can see with his own eyes that every time he is called to attend, as physician, upon the sick, his very presence is detrimental to their recovery, while his painful attempts to demonstrate to those about him that he is trying to do his full duty, only results in total lack of confidence on the part of all the friends, relatives, and attendants, who draw a sigh of relief when he has left the room, and scrutinize his rather vague directions with suspicion.

The same applies to all the other incongruities that I cited above; and examples of every one of them for the last thirty years could and still can be found at any time represented in the government, and in most instances require a radical change, to say nothing of the benefits that would result to humanity for all time. R. W. SHUFELDT.

Fort Wingate, N. Mex., March 14.

The silver problem.

It is generally taken for granted in arguments on this and finance or money problems generally, that the state of business, industry, or economic prosperity, of the nations as they now exist, depends in a very large measure on the substance of which their money is made. Stagnation, crises, and all the baneful consequences thereof, are ascribed to the money system without any intelligent reason.

Money is any thing whose exchange value serves as a standard for measuring the exchange value of other things or of services. It follows that the best money is that whose exchange value is most fixed and unvarying. By a 'survival of the fittest' process, gold now has gained its place as the money best fitted for our present economic system; i. e., the exploitation or capitalistic system.

The customary blunder of the finance tinkers and thinkers is to ascribe the evil results of the present economic system to the money or finance department thereof. This they never do intelligently or clearly, and never can, because that relation does not exist: hence the confusion and general intellectual bankruptcy that prevails on this issue. In the prevailing capitalistic system, money and all other exchange values are permitted to become private property. The producers of exchange values have to give them over to a middleman (capitalist), who compels them to do that by the power of the state, which upholds him therein by upholding him as owner of the means of production. But the producers are by this process exploited (fleeced) by this third party. For example: a shoemaker and tailor would, if free to make their exchange directly, exchange, say, three pairs of shoes for two coats. But the middleman (capitalist) fleeces both by keeping for himself as much as he possibly can of the labor-products of both, without giving any thing in return. He gives the tailor in money the exchange value of only one pair of shoes in exchange for the two coats, and the shoemaker only the exchange value in money of one coat for the three pairs of shoes: consequently, by the hocus-pocus of the money system, he is 'in' one coat and two pairs of shoes. This right to be 'in' is his 'legal' or 'vested' right, — his 'profit.' The producers may deem it a 'vested wrong,' and a great many are beginning to think that way.

Besides being a 'shaving' system, it is also a 'competitive' system; that is, those workingmen get the 'prize,' work and wages, who will live in the meanest and cheapest manner; that is, who work for the lowest price, or, in other words, who will consume the least. The capitalist gets the prize, 'profit,' who has the most integrated and differentiated means of production along with the cheapest labor; that is, who can produce the quickest and most. On one side, the consuming power is decreased; on the other, the producing power is being increased; and in the middle both are fleeced. The result is this remarkably anomalous spectacle of people who are willing to work suffering from want because there is too much produced, and non-producers consuming enormously.

Herein, and not in the money department, is the real 'root of the evil.' Only a remedy that goes to this root, that is, in the root-sense of the word, *radical*, will cure the evil. This remedy is socialism.

CHAS. FIELD.

A swindler abroad again.

A person has been operating in Illinois and Iowa, representing himself to be Prof. H. S. Williams at some points, and Professor Oelrich at others; in all cases, so far as heard from, assuming to be connected with the faculty of Cornell university. His *modus operandi* is to borrow scientific works, money, and paleontological specimens, and contract with colleges to furnish series of fossils illustrative of American geology. He is an expert in classifying fossils, and his method of work is strongly suggestive of the individual who duped many scientific workers last year under the *alias* of Lesquereux. He has worked his games at Galesburg, Ill., Burlington, Mount Pleasant, Ottumwa, and Oskaloosa, Io., being at the latter place March 8 last. He is undersized, a man of from thirty to thirty-five years of age, light hair, beard, and mustache, and apparently having no use of his right arm, though this defect may have been simulated. H. D. CRAWFORD.

Ottumwa, Io., March 18.

Reports of the National academy of sciences.

From inquiries which I have received, there appears to be a general misunderstanding concerning the reports made by committees of the National academy of sciences. It is assumed by the public that these reports have been examined and approved by the academy, and therefore that they express the opinion of that body. This is a mistake. Generally a report is not submitted to the academy for discussion, and it must be understood to represent only the opinion of the committee who sign the report. An example will be found in a late report, published as senate document No. 67 (forty-ninth congress, first session), in which it is recommended to change the beginning of the astronomical day from noon to midnight. Probably a majority of the astronomers of the academy would oppose such a change if they were permitted to speak. ASAPH HALL.

March 18.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 26, 1886.

EDUCATIONAL TENDENCIES IN JAPAN AND IN AMERICA.

IT has for some time past been a cause of wonder that the bureau of education has been able to do so much and so good work with the limited means at its disposal, and receiving but slight recognition from the other governmental departments. Two recent circulars of this bureau will, by their great interest and value, serve to increase this wonder.

One of them deals with education in Japan.[1] The population of the empire in 1882 was 37,041,-368, and the school population, comprising all children between the ages of six and fourteen, made up 5,750,946 of this number.

Education is given more official consideration in Japan than here, for it constitutes one of the ten departments of the privy council, and has a minister allotted specially to it. The school organization follows closely the division of the empire for administrative purposes into nine circuits and eighty-four provinces. A school committee is organized in each minor civil division, ward or village; and it conducts all business relating to school attendance, the establishment and maintenance of schools, etc., within its jurisdiction. The tenure of such a committee is not less than four years, and it is composed of men selected by the governor of the province, from a list nominated to him by the citizens of the school district. A committeeman must be over twenty years of age, a property-holder, and a *bona fide* resident of the district from which he is nominated. The directors, librarians, professors, and teachers are appointed and dismissed in various ways, according to the importance of their office. Some are appointed and dismissed by the emperor himself, others by the prime minister on the recommendation of the minister of education, others by the minister of education himself. Their salaries range from 4,800 yen (one yen is equivalent to 85.8 cents) in the case of a rector or a professor of highest grade, to 540 yen or less in the case of an ordinary teacher.

Education has been under government supervision in Japan since 270 A.D., but it was in the years from 1868 to 1871, following the political reform of the country, that it was placed on its present footing. The present educational code only dates from 1880. The school system comprises kindergarten, elementary schools, middle schools, and a university at Tokio. There are also female schools, commercial and industrial schools, and normal schools for the training of teachers. Nineteen libraries and four museums of high rank are under the control of the department. Students are frequently sent abroad to complete courses of study, fifty having been so sent since 1875. Twenty-two such students are abroad at present, seventeen of whom are in Germany. The school funds are raised as part of the national taxes, and the lands occupied by schools are usually government lands: when they do not belong to the government, they are exempt from taxation. In 1881 the educational expenses of the empire amounted to 6,591,878.123 yen, — about 36 per cent of the total expenditure. 8.8 per cent of the entire population were under instruction in 1883 in 30,156 elementary schools, engaging the services of 24,-605 teachers, 1,878 assistant teachers, and 64,017 pupil teachers.

The second of the reports to which we have referred is no less replete with information than the former, but from its character it contains more that is suggestive. It was drawn up by the late Charles O. Thompson, Ph.D., of Terre Haute, Ind., and is an essay on technical instruction in Europe.[1]

Into the details of this report space forbids us to enter, but it is a valuable compendium of the system and methods of technical instruction in the various countries of Europe. America is by no means deficient in recognizing the importance of technical schools; but we need to learn all we can on this subject, and call to our aid, when attainable, the experience of other countries, for technical education bids fair to be the education of the future. In our development of free education we have tended to overestimate the dignity of the professions and to underestimate the dignity of the trades. From Germany comes the cry that there are too many educated men, and not enough places for them; and in our large cities we see

[1] *Circulars of information of the bureau of education.* No. 4, 1885. Education in Japan. Washington, *Government*, 1885. 8°.

[1] *Circulars of information of the bureau of education.* No. 3, 1885. A review of the reports of the British royal commissioners on technical instruction, with notes, by the late Charles O. Thompson. Washington, *Government*, 1885. 8°.

hundreds more lawyers and doctors than can obtain a decent living.

The remedy for all this must lie largely in technical education. Teach a trade and the practical application of principles, and inculcate the lesson that no calling is dignified in itself, but it becomes what those who follow it choose to make it. We believe that Professor Thompson's essay is a positive contribution to our knowledge of this subject, and therefore should be carefully studied by all who are interested in education.

NICHOLAS MURRAY BUTLER.

THE CHARACTERS OF CHILDREN AS EVIDENCED BY THEIR POWERS OF OBSERVATION.

THE study of the powers of observation in children has been seldom attempted in a systematic way; and yet, with the tendencies and aims of modern education, there can scarcely be any subject from which might be expected more fruitful results. Professor Farlow, in his recent address before the Society of naturalists, has asserted that the schools, in the last six or seven years, have made no perceptible progress in developing these powers, and that, so far as elementary training is concerned, we are about where we were ten years ago. Furthermore, in his own experience, he finds that the tendency of education, in the lower schools at least, is to impair, rather than to sharpen, the natural powers in this respect. Considering how important an element of successful work, in most careers, this faculty is, one cannot fail to appreciate the value of experiments that may throw light upon remediable mental defects, or upon mental excellences, in childhood.

At the suggestion of Mr. Francis Galton, Mrs. Sophia Bryant, D.Sc., has recently [1] attempted a series of such experiments, the results of which, though subject to fallacies, will point out a fruitful line of investigation.

Her method was the analysis of the characteristics evinced in the description of given objects by a number of school-children, all of whom were of the same age (thirteen years), and unknown to her. For this purpose they were allowed to remain for about ten minutes in a room which they did not know, and were then required to write a description of it. The one first described was a schoolroom, having certain features in common with other schoolrooms familiar to the children, but having certain others peculiar to itself, and a sufficient amount of ornament, in pictures and otherwise, to redeem it from being quite prosaic. The results of her analyses were afterwards compared with the characteristics as given by the children's teachers; from which comparisons, in many cases, striking agreements were found. Of course, in such experiments, as the author rightly says, only repeated and varied trials can eliminate the chances of error; and much less weight should be attached to negative than to positive results. The points thus brought out were as follows: —

1°. In the perception of an object a logical distinction is made between the sense-impression and the apprehension of it by the mind, as between the passive and active factors of perception. Apprehension is essentially the bringing of the new into relation with the old, and thus interpreting the new by means of the old.

In the ratio of these two factors of perception to each other, there were found signs of great variety. Impressions were sometimes numerous and faithful where the power of giving them a meaning, and thus perceiving them fully, was clearly very slight, or at least inoperative. In such cases the perception was what would be ordinarily called unintelligent. In other cases the impressions either made, or at any rate dwelt upon, were fewer, but the apprehension of them was very complete. This completeness of apprehension or understanding occasionally passed beyond the limits of full and accurate perception into pure inference. Sometimes the inference was correct, and that not by chance, since it had the marks of having been cautiously conducted. Such little phrases as 'I suppose,' or 'it is likely,' are tell-tales here, as marking off the cautious from the reckless thinker. This latter person was betrayed also by a very unmistakable hastiness of inference, which in the bad cases degenerated into actual false perception. For instance: the name 'C. W.' in the corner of a picture was reported as 'M. W.,' this being the name of a girl in school whom the young observer knew very well.

It was found, as indeed might naturally be expected, that the false perceivers were nearly always ready apprehenders, who, apparently digressing into actual inference, inferred carelessly, and projected their false inferences into false perceptions. The carelessness of such inference is of a very simple character: the impressions to the test of which the inference should be brought are there, and it is not brought to the test. This argues absence of the impulse to criticise, which is the basis of accurate habits of thought. Feebleness of the impressions is, it must be admitted, a negative cause for the false perceptions, since the test is thus kept in the background; but it is only

[1] *Journ. anthropol. inst. of Great Britain and Ireland*, xv. 338, February, 1886.

a negative cause, since, if the critical impulse were really strong, the inference would be challenged at least, even if it could not be corrected. In judgments, however, as to character-tests, it would be necessary to estimate this negative cause as otherwise indicated, and allow for it before deciding on the degree of the critical defect.

2°. In the second place, differences were observed in the degree of orderliness with which perceptions are marshalled, and in the general notion of order which characterizes any particular observer.

Out of twenty observers, eight gave evidence of no noticeable interest in order at all: the objects appeared to have been observed haphazard, as far as their relation to one another logically, or in place, went. On the other hand, seven descriptions were as orderly as they could well be expected to be; while to three, half marks were given, and to one two-fifths. In most of the orderly descriptions the order chosen was that of place, — the order of the inventory round the room, some starting from the door, some from the opposite point, and some from the clock in the middle. In one or two the order was logical; i.e., the order of what may be called the idea of the room, as in one paper which begins, "The first thing that strikes you are the rows of desks and girls." In another set of papers, describing a more ornamental kind of a room, signs were found of a third kind of order, sometimes very strong, — the order, namely, of aesthetic effects; the order in space, and in idea too, being subordinated to the order in feeling for the beautiful.

3°. Great differences in color-interest were also observable, since some took pains to describe colors fully, while others took no notice of color at all, or very little. In the same way, any marked interest in form was also shown; though in the experiments under consideration no call was made upon the form-interest so strong as to test defect by the absence of response.

4°. One other characteristic, and a most important one, came out into strong relief in a few cases. This is the tendency to substitute feeling for thinking, to apprehend impressions as the minimum of idea with the maximum of emotion, which may be called, for simplicity, over-emotionalism. An over-emotional person perceives objects habitually as sources of feeling; and that is, of course, equivalent to not properly perceiving them at all. Now when, in the description of a room, a child tells you that it is very beautiful, and there are lovely curtains, and the sweetest flowers, and pretty ornaments, it may be considered an evident mark of over-emotionalism, and should, in the educational interest, recommend a wholesome diet of ideas accordingly. The negative defect — for, after all, it is a defect — of under-emotionalism is, like all negative defects, difficult to test; but the freedom from defect reveals itself every now and then in little touches that are very subtle.

In other observations made, a picture was used as a test. The same contrasts as before were to some extent brought out in the various descriptions of the picture; but there was occasion for another set of contrasts in these cases, and these contrasts came out decidedly. To see a picture in the full sense is to understand its meaning, and in the interpretation of meaning there is abundant scope for the most varied play of imagination, whether checked by faithful observation or not. Just as the perception of an object resolves itself into the two factors of impression and apprehension, so the observation of a complex of objects resolves itself into the two factors of perception and explanation by means of appropriate fetches of the constructive imagination. Now, in some children there was found abundant and accurate perceptive detail, with something like the minimum of constructive explanation. In others the opposite extreme was manifest, explanation good, and details little dwelt upon or even described with imperfect accuracy. Between these extremes the two factors were combined in various ratios, including the ratio of equality characteristic of the well-balanced type of mind.

Again, varieties in the nature of the imaginative play, which suggested well-marked contrasts of general character, were observed. Sometimes the play of imagination was almost purely intellectual, strictly subordinated to the purpose of fetching ideas for the explanation of observations. This may be called the logical or intellectual imagination. In other cases the fetch of imagination was not so much after ideas to construe with, as after feelings to luxuriate in: the ideas are overpowered in a mass of vague associated emotion. This, if it can be called imagination at all, may be marked out as the emotional variety; and a touch of it is not, of course, out of place in describing an object like a picture, which has distinct aesthetic bearings. But most striking of all were the examples of dramatic imagination, which were not rare: here the picture is lost in the story which it is interpreted as meant to tell; the picture becomes the occasion for a departure into story-land, instead of remaining, as in the first case, the main fact, solely for the explanation of which such departures are at all allowed, and by which they are limited. Besides these marked cases, there were doubtful cases, and cases negative altogether. Sometimes, too,

the play of imagination was markedly careless, and uncontrolled by the inward critic, as compared with the good cases in which it showed itself sober and self-controlled.

As the author says, the sources of error in such observations as these are very numerous; but from repeated observations by many observers, carefully collated, these errors may be in a great measure eliminated, and substantial results arrived at, of whose practical bearing there can be little doubt.

OBSERVATIONS UPON DIGESTION IN THE HUMAN STOMACH.

DIRECT observations on digestion in the human stomach have been very seldom made, as opportunities for such cannot often occur. Those by Beaumont many years ago are familiar to every student of physiology, and, notwithstanding their lack of completeness and their many imperfections, they served a very useful purpose in explaining many of the processes whereby digestion is affected in this organ. These observations have been supplemented by others; but the results of modern physiological researches have been such, that renewed opportunities to make such direct observations must be of great value. Such a one occurred within the past year in the person of Heinrich Baud, a healthy young man twenty-eight years of age, into whose stomach, in consequence of a stricture of the oesophagus that prevented the passage of all food, a surgical opening five centimetres in length was made. The case passed into the hands of Mr. A. Herzen, the well-known physiologist, who improved the opportunity to make a series of experiments upon the digestibility of certain foods and upon the behavior of the gastric juices (*Kosmos*, 1885, ii. 1, 4). The pepsin secreted by the patient was of unusual quantity, and, what has hitherto never been observed in similar cases, or through the artificial fistulas of dogs or other animals, there was a changeable but often considerable quantity of bile present. These circumstances, however, though complicating the experiments, did not especially affect the results.

The author's methods of experimenting were as follows: a substantial meal was given to the patient at 7 o'clock in the evening, and nothing further was permitted to enter his stomach till the next morning, when experiments at 6 o'clock were begun, first upon the empty organ. After an examination of the juices therein contained, there was introduced the albumen from three hard-boiled eggs, with two to three hundred grams of water, together with three small silken nets, each containing eight small pellets of albumen, uniform in size, and regular in shape, and which could be easily withdrawn for examination. These observations through the fistula were made hourly, and one of the nets with its contents removed.

Remarkable and unaccountable conditions were found in which the albumen remained one or even two hours in the stomach without undergoing any perceptible change, notwithstanding the presence of ferment, with which it was impregnated. In these cases the albumen pellets usually retained in their substance precisely the requisite quantity of pepsin for their solution, which, under favorable circumstances afterwards, exactly sufficed to digest them. This furnishes evidence that the pepsin does not act through simple contact alone, and that a given quantity of it can dissolve only a given quantity of albumen, and that consequently the pepsin, by the exercise of its digestive activity, loses its entire potency.

Observations directed toward the ascertainment of the time required for the stomach-juices to impregnate coagulated albumen showed that they penetrated about one millimetre during the first hour and three millimetres within the second. It was also learned that the acids were much more active than the pepsin in penetrating the substance. This last fact furnishes a new proof of the presence of a free acid in the stomach-juices. The juices, however, at such opportunities as it was possible to examine them, were sometimes found to be of a neutral reaction. But, in order to test the action of acid and ferment further, he introduced at times a quantity of soda to neutralize the acid; without, however, materially affecting the activity of the pepsin, although it appeared to somewhat diminish it. It therefore results that pepsin exerts its digestive power almost wholly independently of the acid. The reverse of this, as may be expected, was also found true, — that the acids penetrated the albumen in the absence of the pepsin, and, when the pieces of albumen were small, a sufficient quantity was absorbed to digest them.

Another series of researches was made upon the fluids of the stomach, from which it was found, that, on the mornings after fasting, the secretion usually was small, while at such times following the ingestion, during the night, of milk or any fluids containing alchohol, the secretion was greater. During the first hours of digestion the quantity held a definite relation to the volume of substances introduced, while in the fifth hour the quantity was always more abundant, about three or four hundred grams. The first secretion of the morning was in general a somewhat thick, very stringy, more or less clear fluid, which resembled the white of an egg; that obtained during the

process of digestion was less thick and less stringy; while that of the fifth hour was turbid, thin, and little or not at all stringy.

Of the hundred and forty-two specimens examined, one hundred and seven showed a yellow or green color, more or less intense, and which indicated the presence of bile. It is worthy of note, that, despite the almost constant presence of bile in the stomach, the digestion was not perceptibly disturbed, and analyses of the contents of the stomach during different hours of digestion clearly proved that the activity of the fluids was not impaired by its presence. It was also observed that the entrance of bile into the stomach partook of a sort of periodicity, a less quantity being found during the first two hours of digestion than at the time either before or after, and that the quantity was still less during active digestion, when fluids, especially beer, were taken in.

The hydrochloric acid of the juices during digestion was found, in a mean of eighty-seven examinations, to be from 1.8 to 1.9 per cent in weight of the entire quantity, — a somewhat higher percentage than that given by Richet. The acidity gradually increased during the first hours of digestion, reaching its maximum at the third hour, from which time it gradually decreased. A few times the juices were found neutral, and the highest acidity attained was 4.2 per cent.

Since Dr. Koch has shown that an acidity equivalent to two per cent of the gastric juices suffices to destroy the cholera microbe, it has been recommended that table-salt should be employed during cholera epidemics to increase the quantity of acid in the gastric juice, and thus prevent the entrance of these germs into the alimentary canal; but from a series of experiments it was ascertained that the direct reverse was the result, and that the larger the quantity of salt introduced, the more considerable and permanent was the decrease of the acidity, so much so that at times the juices were rendered entirely neutral. Contrary to the opinions which have been expressed by physiologists, that salt increased the activity of the secretion of pepsin, experiments seemed to prove that it hindered such secretion, and when large quantities were taken, either into the stomach or by injection, the stomach digestion was most impaired. Mr. Herzen, however, would by no means deny the probability that salt injected directly into the blood increases the secretion of pepsin. On the other hand, it was established that the introduction, either by the stomach or the rectum, of some good peptogenic substance, such as broths or dextrine, uniformly hastened digestion in the stomach, and that this resulted independently of the increase of acidity, and despite the frequent presence in the stomach of the contents of the duodenum. In other words, the digestion may be hastened, and a richer secretion of pepsin brought about, by their use; while others, such as tea, wines, and grape-sugar, produce no effect whatever. Of the practical results of such observations, corroborating and adding to, as they do, conclusions previously and in other ways arrived at, there can be no doubt. Those who would aid an impaired digestion may seek in certain foods, such as broths, stale bread, milk or coffee, taken a while before regular meals, efficient helps; while alcoholic drinks, and especially the sour wines, sugars, and others, may be not only of no use, but even actually prejudicial. To the child and the invalid the results are no less useful.

BLINDNESS IN RUSSIA.

AT the first congress of Russian doctors, which was held in January last, many important papers were read, followed by discussions of considerable interest, some of the most eminent members of the profession from the different provinces and universities of the empire taking part in them. A very striking contribution to the study of social and sanitary questions, says the *Lancet*, was afforded by a paper by Dr. A. T. Skrebitski, on the 'Distribution and statistics of blindness in Russia.' The data employed were chiefly those collected by the military authorities who have to examine young men as they become liable to service in the army. Taking the total for the five years 1879 to 1883, the number examined was 1,388,761, of whom 13,686, or almost one per cent, were blind in one or both eyes. In certain districts the proportion was much higher than the average; and some of the largest, or rather most populous, provinces seem to have presented the greater proportion of the blind: thus in that of Kieff, which sent up almost the largest number of recruits, — namely, 43,118, — no less than 660, or 1 in every 65, were found to be blind in one or both eyes. The smallest proportion of blind was found in Archangel, where it was 1 in 390; but even this is far above the proportion in other European countries.

To make the comparison with the statistics of other countries, it is necessary to subtract the number of those blind in one eye, which in Russia is found to be only a fifth of the total blind: thus, we may consider that four-fifths of the 13,686 recruits returned as blind were blind in both eyes, so that the ratio of totally blind is about 1 to 125. The ratio in England and Ireland is 1 to 1,015, and that in several other European coun-

tries is still lower, being 1 to 1,406 in Saxony, and 1 to 1,429 in Denmark. Dr. Skrebitski's paper attracted a considerable amount of attention from the lay press, the *Novosti* remarking, "We have surpassed Europe not only in mental but in physical blindness." To any foreigner, however, who reads the Russian medical journals, the valuable original communications with which they literally teem would appear to indicate the reverse of 'blindness,' in the Russian scientific world at all events.

BANCROFT'S HISTORY OF ALASKA.

The history of Alaska, up to the time of the American purchase, has two divisions into which it naturally falls, — the period of independent Russian traders, fighting and competing on every hand; and the period of organized monopoly, which succeeded that competitive anarchy. Explorations of a rude sort, the vices of the semi-civilized Cossacks, and the rage for wealth represented by sea-otter skins, went hand in hand. A myriad of petty traders, bold, energetic, lustful, and avaricious, after the return of Bering's expedition, swarmed upon the Aleutian Islands, trading, hunting and robbing the natives, occasionally being slaughtered in return.

Of this period, with the causes which led to it, and its consequences for Russia and for America, Mr. Bancroft gives an extremely full and almost interesting account. Parts of it are dramatic; but the annals of so many petty expeditions with the same object, and almost always substantially similar results, cannot but be rather monotonous. Though much of the material is of only approximate accuracy, and derived from scattered and unverifiable copies of old records long destroyed, Mr. Bancroft has given what would seem to be by far the best account extant, and one not likely to be improved upon.

Of the second period we have also a remarkably full and acceptable account of the formation, fortunes, and fate of the monopoly known as the Russian American company, and of Alexander Baranoff, the man of all others characteristic of the Russian occupation of Alaska, the Peter the Great of the territory. Of history in its widest sense, the grasp of underlying motives, — the reaction of European politics, the growth of the United States, and other large forces upon the springs which governed events on the north-west coast, — there is little: the volume is rather materials for history, than history. But it is for he Russian period a very full, and in the main sufficiently accurate, chronicle of events. Of the period succeeding the purchase (a much more difficult task) less can be said in praise. A similar division of this epoch will by its future historian be found applicable. The era of violent and unrestrained competition in this case, however, lasted only two or three years; while the monopoly which succeeded, though more confined in scope than that of the Russian company, does not differ in its essential characters, and is still in operation. The chronicle of events since 1867 is full, but by no means complete. The scientific investigations, which have been a marked feature in the recent development of the territory, are very unequally treated, and many of them pass with a bare mention; others are ignored altogether; while a disproportionate space is given to the petty affairs of the trade-monopoly above referred to. There are numerous errors of detail; and the just reprobation of misgovernment and lawlessness, which the (mostly foreign) fur-traders under American sovereignty should share with the still viler authors of the early Russian trade, seems to have been reserved for the former in unreasonable proportion. This period, however, is so much nearer the historian, so many of the actors in it are still in the active pursuit of their business, and the passions and prejudices engendered by recent rivalry are still so hot, that historical impartiality is not to be expected.

Mr. Bancroft recognizes the wealth of the territory, and gives an excellent account of its hardly touched resources, other than the fur-trade. He very justly and severely criticises the inaction of congress, which has left the territory at the mercy of law-breakers for more than fifteen years, has only recently accorded a merely nominal and almost impotent form of government, and in the past has saddled upon the inhabitants, in lieu of the law they had a right to, a succession of corrupt or inefficient petty officials. The book has an excellent index, and numerous small sketch-maps in the text. The general map of the territory is bad, out of date, and in nomenclature discrepant with itself and with text, beside containing several inexcusable and wholly original blunders.

History of Alaska, 1730–1885. By Hubert Howe Bancroft. San Francisco, *Bancroft*, 1886. 8°.

OCEANA.

Sir Arthur Helps once said that when Lord Palmerston was forming a new ministry, not so very many years ago, he was at loss for a colonial secretary. This name and that was suggested, and thrown aside. At last the noble lord said,

Oceana; or, England and her colonies. By James Anthony Froude. New York, *Scribner*, 1886. 8°.

"I suppose I must take the thing myself. Come up stairs with me, Helps, when the council is over. We will look at the maps, and you shall show me where these places are." It occurred to Mr. Froude that it would be a good thing not merely to find out where the colonies were, but to make a tour among them, to talk to their leading men, see their countries and what they were doing there, learn their feelings, and correct whatever erroneous impressions he himself shared in common with his countrymen. He sailed for Melbourne in the beginning of December, 1884, in the new steamship Australasian; and on the 16th of May, 1885, he landed at Liverpool from the decks of the Etruria, on her first return vogage from New York. In this volume the events of that trip around the world are most charmingly narrated.

His first encounter, however, was with an inhabitant of an island much nearer Downing Street than New Zealand. He thus narrates the incident: "I saw an Irishman in the unmistakable national costume, the coat-seams gaping, the trousers in holes at the knees, the battered hat, the humorous glimmering in the eyes. I made acquaintance with him, gave him a pipe and some tobacco, for he had lost his own, and tempted him to talk." The man, who had probably never heard of Mr. Froude or his books, opened his heart to him. After describing how the Manx men had come down and taken all the herring in his neighborhood (for it seems that he was a fisherman), he went on: "And then there was the bit of land" — here he paused a moment, and then continued, "Thim banks was the ruin of me. I had rather had to do with the worst landlord that ever was in Ireland than with thim banks. There is no mercy in them. They'll have the skin from off your back." Poor fellow! No sooner had he got fixity of tenure than he had borrowed money on the strength of it, and the result was emigration to the antipodes. "How many hundreds of thousands of his countrymen will travel the same road?" queries our author.

A few hours only were devoted to the Cape of Good Hope; for Mr. Froude had sojourned there ten years before, and had seen all of the misgovernment of that colony that he desired. Adelaide was merely glanced at, but a long and interesting visit was paid to Melbourne and Sydney. A trip was taken to Ballarat, Bendigo, and other points in the interior of Victoria. Everywhere he was well treated, and everywhere he saw nothing to blame and much to praise. He was in a land where patriotism was not "a sentiment to be laughed at — not, as Johnson defined it, 'the last refuge of a scoundrel,' but an active passion." He predicts a glorious future for Australia. People wrote to him afterwards that he had purposely been shown the bright side of things, "that we let ourselves be flattered, be deluded, etc. Very likely. There was mud as well as gold in the alluvial mines. The manager pointed out the gold to us, and left the mud unpointed out. The question was not of the mud at all, but of the quality and quantity of the gold. If there is gold, and much of it, that is the point. The mud may be taken for granted." Rather a dangerous method of investigation, one would say, and a method the pursuing of which has destroyed much of our faith in Mr. Froude's deductions.

He next passed over to New Zealand, this time in an American steamer. But though the captain and the steamer were American, the crew was not. Indeed, our author, puzzled to make out what they were, asked the captain how he had picked them up. "I make a rule," the captain replied, "to take no English, no Scotch, no Irish, no Americans. They go ashore in harbor, get drunk, get into prison, give me nothing but trouble. It is the same with them all, my people and yours equally." He preferred Danes, Norwegians, Germans, Swedes, and Chinamen. It took five days to make the voyage from Sydney to Auckland. Then followed a month mainly devoted to sightseeing in the wonderful volcanic interior of the North Island. This part of the book is well illustrated, and we remember no better description of the last retreat of the Maori. In fact, it makes one wish that the author had devoted more of his time to descriptive writing, and less to historical dissertations.

From Auckland he voyaged to San Francisco *via* Honolulu. It is always pleasant to hear one's country and countrymen praised, and Mr. Froude has been by no means stingy of praise when speaking of us. "The Americans," he declares, "are the English reproduced in a new sphere. What they have done, we can do. The Americans are a generation before us in the growth of democracy, and events have proved that democracy does not mean disunion." But all the desirable results were not brought about by the spirit portrayed in the following sentence. He has been speaking of the scheme for a real imperial parliament (something akin to our congress) to take charge of the 'foreign and colonial policy' of a federated British empire, — Oceana, — and says, "Of all the amateur propositions hitherto brought forward, this of a federal parliament is the most chimerical and absurd." Why? it may be asked. Because the English house of commons is omnipotent, is the reply. "Who is to persuade it to abdicate half its functions, and construct a superior

authority which would reduce it to the level of a municipal board?" It may be safe to say, that, until the English house of commons does consent to divide its authority with some kind of a legislative body in which the Englishmen who happen to live in Canada and Australia shall have a voice, every scheme for an 'Oceana' will prove 'chimerical and absurd.'

MINOR BOOK NOTICES.

New theories of matter and force. By WILLIAM BARLOW. London, *Sampson Low & Co.*, 1885. 8°.

MOST theorists, in seeking to escape from the difficulties in the way of an adequate conception of the luminiferous ether, would hesitate to embrace a theory which involved either the denial of the conservation of matter or the acceptance of the emission theory of light; and yet the author of 'New theories of matter and force' has no craven fear of either or both of these conclusions. Ordinary matter, he conceives, is a mixture of two hypothetical ethers in a highly condensed state. The properties of these ethers are peculiar. Both have inertia, and, when unrestrained, expand indefinitely like gases. One is more compressible than the other, and cohesion in each is proportioned to the density. To avoid all appearance of action at a distance, this cohesion is not supposed to be an attraction, but rather a clinging-together of contiguous particles. This seems to require these ethers to be continuous; but this is no serious embarrassment to our author, who finds no difficulty in reconciling perfect continuity of substance with any desired degree of compressibility. Owing to the diminution of the cohesion with the density, these ethers have the remarkable property that the expansive force increases as the volume becomes greater. By means of these two ethers we have the fundamental machinery for the complete explanation of matter, gravitation, light, heat, and electricity. The greater part of the book is devoted to the application of the theory throughout the whole realm of physics, supplementary hypotheses being courageously introduced when necessary. The main phenomena of light are explained by a combination of the wave and emission theories, as interpreted in the light of two ethers. It is much to be regretted that the author, before publishing his theory, did not subject it to a scrutiny at least as rigid as that which led him to reject the accepted views. The scientific imagination has an important use when stimulated by knowledge and guided by reason; but before we lightly cast aside those theories which are the result of the most profound thought, not of one mind, but of many, and which have been slowly elaborating during patient years, and set up in their stead our own brief conceits, we may well pause and consider.

The determination of rock-forming minerals. By Dr. EUGEN HUSSAK. Translated by Dr. E. G. Smith. New York, *Wiley*, 1886. 16°.

THIS is a work of which we cannot speak favorably. Dr. Smith's evident lack of acquaintance, both theoretical and practical, with the subject, has compelled him to make a close literal translation from the original; and, as would be expected, numerous errors have thus crept in, in addition to the many in the original. The whole spirit of the German language is such that close translations of technical works are rarely happy in their results — certainly never, except when one is most thoroughly familiar with both the language and the subject under consideration. It is very much to be doubted whether Dr. Smith possesses either of these qualifications; otherwise he would never have made such errors as 'the entrance face of the light' (*eintrittsfläche*) for 'plane of incidence,' and 'shell-formed' (*schalenförmig*) for 'zonal.'

Along Alaska's great river. By FREDERICK SCHWATKA. New York, *Cassell*, 1885. 8°.

THIS excellently illustrated volume describes the journey of Lieutenant Schwatka's exploring-party from Portland, Ore., through the beautiful inland passage along the north-west coast of America, as far as Sitka in Alaska, thence overland to the head waters of the Yukon River, which was explored with considerable accuracy by his expedition as far as Fort Yukon. Schwatka's raft-journey down the Yukon, and his explorations in that region, have been often referred to in these columns. Capt. C. W. Raymond, of the engineer corps of the army, had surveyed and charted the Yukon River from Fort Yukon to its mouth, about a thousand miles, as early as 1869, and Schwatka pays a deserved tribute to the accuracy of that officer's work. In fact, the large chart of reference accompanying the volume appears to be a reduced copy of Raymond's chart, which is said to be the best in existence of that part of the great river. It is to be regretted that Schwatka's time for this exploration was limited to one short summer, and that his arrival at St. Michael's had to be so arranged as to anticipate the departure of the last vessel going south from that point in the fall. Otherwise it is almost certain that he would have explored a much wider region, thus adding much to our knowledge of that almost unknown American territory.

SCIENCE.

FRIDAY, APRIL 2, 1886.

COMMENT AND CRITICISM.

THE SUBJECT of agricultural experimentation is coming more and more to the front, both by the multiplication of state experiment stations, and through the endeavor to secure national aid. But, while the making of experiments in increasing numbers appears to be assured for the immediate future, the more important subject of the interpretation of experiments appears to receive but little consideration. It seems to be assumed, that, once an experiment is honestly made, its teachings will be so obvious that he who runs may read. As a matter of fact, however, the correct interpretation of the results of an agricultural experiment (we speak now of scientific experiments) is a matter of no little difficulty, and is deserving of equal attention with the making of the experiment. We are glad to note that the director of the New York experiment-station, in his last report, which we notice in another column, emphasizes the importance of a proper method of interpretation and of the application of the doctrine of chances. In the strictest sense of the word, no agricultural experiment can as yet be called scientific, because in none do we so fully understand the conditions as to properly control them. In all experiments with plants or animals, we have to reckon with the individual peculiarities of the organism; and, except under the most favoring conditions, there are other conditions which cannot be accurately controlled or allowed for. As a consequence, the final result of such an experiment, or series of experiments, is a probability, greater or less as may be, that a certain law holds. The subject is too broad a one to be discussed here; but we are convinced, that in proportion as agricultural experimenters learn to distinguish clearly just what and how much their experiments really prove, will they be in condition to make more rapid and certain progress in knowledge.

A CONTEMPLATIVE and retrospective naturalist can hardly escape the curious fantasy that the very term 'fishes' may become altogether obsolete, unless, indeed, it survives in the future as an historical reminiscence of the time when men thought there were 'fishes.' In fact, the word has lost by successive trimmings a large share of its ancient scope; for it is only by generous etymological tolerance that we graciously permit ourselves to still talk of the invertebrate cray-fish and shell-fish as fish at all, and we feel a comfortable sense of sustained politeness towards our more ignorant ancestors, while we order the waiter to fetch us some of the same tid-bit fishes. Then we learned to extend our linguistic purism to the very vertebrates, and became wise with the knowledge that those evident fishes, the porpoises and the whales, are not fishes at all. But the taste for lopping off the meaning from an innocent word had grown by indulgence; and so, having cut off the top of the fishes of our fathers, we turned to the bottom, which we added in our own day, and removed Amphioxus. We are quite agreed that the poor creature is not even a fish. Just at present we apparently are making ready for another discardment. The progress of science is rendering it clear that the sturgeon and his congeners — the ganoids all — are more nearly related to the amphibians than to the true fishes. Their development in the ovum is very closely similar to that of the frog and newt, and differs strikingly from that of the bony fishes and sharks. In the structure of the adults, too, the indications point to the same affinity. Of course, if the ganoids go, the dipnoans must go too, as every one will admit. Now appears Monsieur Fulliquet with a valuable study of the brain of one of the latter, Protopterus, and discovers that it is quite like that of an amphibian, and not at all like that of a true fish. Our perplexity fairly reaches its climax, and we wonderingly ask, Is any fish really a fish? If we can forecast the progress of the future by that of the past, we must answer, No.

THAT SOME PORTIONS of New South Wales are not desirable as permanent places of abode year in and year out, may be judged from the fact that during the past three years thirteen million sheep have died from want of water. It is maintained by some that the recent drought was by no means

unprecedented. The Darling River, in 1839, was merely a chain of water-holes; and again, ten years later, it was but little better; in 1851 the river was so dry that grass had grown in it, and in fact it was the only feeding-ground available; in 1863 and 1865, and again in 1868, the water was very low. In 1870 the great wet season began, and it was this superabundance of rain which led to the overstocking of the country and the consequent disaster. It is clear that those who occupy the western part of the colony have to encounter some very bad seasons, intermixed with some very good ones; and arrangements should be made by which the stock which in wet years may be supported, may be transferred to more favorable regions when the grazing fails, or to *abattoirs*, where it can be killed, and turned into canned or frozen meat. There now seems to be some hope for a return of rain, as the natives are reported to be moving to higher ground, and the white ants are said to have commenced building their curious elevated dwellings, which serve them as places of refuge during wet weather. These two indications are referred to by Australian journals as unfailing evidences of a probable change in the weather.

PERHAPS IN NO OTHER branch of zoölogy has the instability of nomenclature become more burdensome than in ornithology. He who, after a lapse of even a few years, attempts to renew his acquaintance with our bird fauna, is depressed and disheartened by the innumerable strange names and tedious lists of synonymes that he everywhere encounters. The Ornithologists' union has recently published a new check-list of North American birds that calls attention forcibly to this evil, but which also contains an excellent code of the principles and canons of zoölogical nomenclature, that, it is hoped, will be of some avail in lessening it. The committee appointed to draught this code was composed of five of our best students of vertebrate zoölogy, and may thus fairly represent the views held by the great body of zoölogists. The most important of the principles therein laid down are: the strict and rigid enforcement of the *lex prioritatis*, without any 'statute limitations' whatever of time; that a 'synonyme once is a synonyme always,' and that the same name cannot be retained for more than one genus in the animal kingdom; that a generic or subgeneric name may be based upon a designated recognizably described species; and that the original orthography of a name is to be rigidly preserved, unless a typographical error is evident. With most of these principles zoölogists in general will agree. The necessity of inflexibility in the law of priority has steadily become more and more apparent; there is no mean position that does not admit of all manner of abuses, and the same may be said of the use of names that have once been synonymes. The last-mentioned principle is also a very important one. In entomology at least, and especially among many German purists, infractions of this safe rule have become in many cases almost unendurable. Those who, in their zeal for philological rules, amend, alter, or even reject names altogether, forget that nomenclature is not the end, but the means, of science. The Greek might write αἱμοῤῥαγία, but the modern zoölogical classicist would insist upon haematorrhagia. The principle, however, that virtually admits catalogue generic names to recognition, will, we believe, receive vigorous protest from many zoölogists, as subversive of the essential rule that a species or genus must be described in order to be accepted. A specific description does not necessarily contain higher characters, and such characters must be given before a generic name can obtain currency. Students in distant parts of the world cannot depend upon specimens. A tyro can say such and such a species belongs to another genus, and give it a name, but it requires scientific discrimination to point out reasons. As well give to the bird-specimen No. 999 in the national museum a specific name, and leave the student to find out the characters as best he can. Ornithologists sometimes forget that rules applicable to their much-studied class may be intolerable in less-known groups.

PASTEUR AND HYDROPHOBIA.

THE place Mr. Pasteur now occupies in the minds of the world affords a striking example of the extremes to which the popular judgment is liable. On the one hand, we have in the 'Pasteur institute' an organization which proposes to put the new method of curing hydrophobia into operation on the largest scale in all civilized countries. At the other extreme we hear from many points the cry that all of Pasteur's pretensions are fraudulent. These extreme views are equally unwarrantable, and equally illustrative of the lack of sober judgment with which the world receives

such attempts as those of the eminent chemist and philanthropist. The sober-minded man should encourage every form of research designed to promote the interests of humanity; but he should at the same time reserve his judgment until sufficient data are at hand for reaching a well-grounded conclusion.

The efficacy of any method of treating hydrophobia must be extremely difficult to test in a way which shall be at all conclusive. The first difficulty we meet in reaching a conclusion arises from the extreme rarity of the disease. The number of readers of these lines who have ever had personal knowledge of a case of hydrophobia is probably very small. In the returns of the last census eighty deaths are reported from this cause in the United States. But we should regard this number as an extreme limit rather than as a well-established quantity, owing to the possibility of other forms of disease being mistaken for hydrophobia. On the other hand, the number of persons who are actually bitten by dogs which, for aught they know, might have been rabid, is very great. It is certainly to be estimated by thousands, and perhaps by tens of thousands. It becomes apparently much greater when, as during the past year, the public mind is excited on the subject. In such a case it is difficult to ascertain, to the entire satisfaction of the injured person, that any dog which may have bitten him was not rabid. The result is, that it is rarely possible to select any injured person as probably being inoculated with rabies. Of the persons brought into an institute for treatment, it may be assumed that only a small percentage would, under any circumstances, develop the actual disease.

Pasteur's supposed success cannot, therefore, be established as a fact until we have more complete evidence of the circumstances attending the injuries, and especially of the rabid character of the animals which have bitten his patients. Even of the well-established cases of bites by rabid dogs, only a minority ever develop into actual rabies, and this minority may require many months for the graver symptoms to appear. The first certain conclusion must therefore be founded on statistics in which the evidence that the animal was rabid shall be conclusive, and in which every result shall be included. A table showing the termination of all cases treated, and of all similar cases not treated, will ultimately be conclusive, and nothing less will serve the purpose. The efficacy of the treatment cannot be disproved by occasional cases of failure, unless it is shown that these cases approximate in number those in which no fatal symptoms are ever developed. This also must depend upon the results of a statistical investigation.

No doubt, a profound impression has recently been made by the failure of the treatment in the cases of the party of Russians bitten by mad wolves; but this failure only shows that the treatment may fail in such extreme cases as these, which seem to have been unusually severe. It is quite conceivable that a process which would be entirely successful in cases so mild as to require several months for their development would prove useless when the quantity of virus injected was so great as to lead speedily to a fatal termination. It is significant that the first Russian to succumb was bitten by an animal so ferocious that one of its teeth was left deeply embedded in the flesh of its victim.

If the final conclusion should be against the efficacy of inoculation, are we to denounce the propounder of the treatment as a pretender? By no means. He will still be entitled to all the credit which society owes to a man who makes an honest attempt to promote its welfare. The character of the great experimenter is above suspicion; and the knowledge which he acquires, if not useful in one direction, may be useful in another. Let us, then, wish him well, and, if he fails, let us still award him the credit due to the spirit which inspired his efforts.

THE MALARIAL GERM OF LAVERAN.

DURING a recent visit to Rome, the writer had an opportunity to see, for the first time, a most interesting blood-parasite, which was first described several years since by Laveran, a medical officer in the French army. Extended researches made in Algeria had convinced Laveran of the constant presence of this parasite in the blood of persons suffering from malarial fevers, and that it is not found in the blood of healthy persons, or in that of those suffering from other diseases; also that it disappears from the blood under the administration of quinine, which is recognized as having a specific curative effect in diseases of this class.

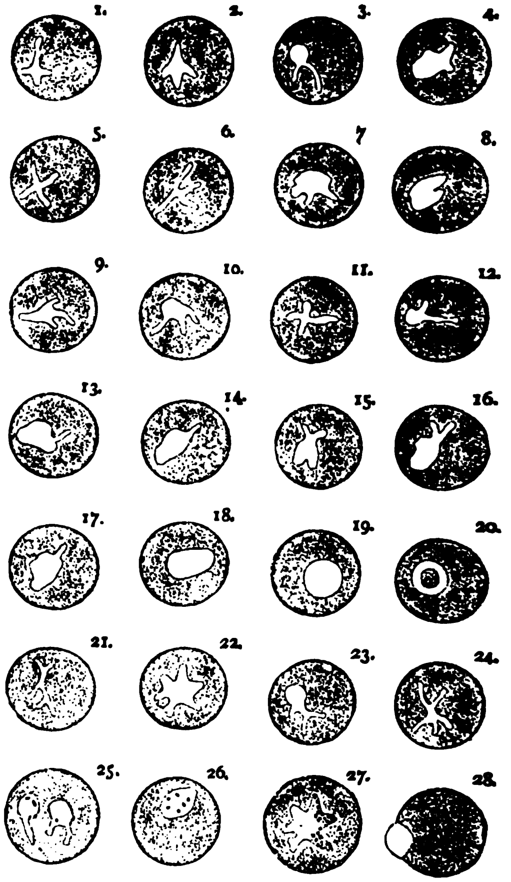
There are many circumstances connected with the causation of the malarial fevers which make it appear probable that they are due, either directly or indirectly, to a living organism which finds its normal habitat in marshy places, and

multiplies abundantly at certain seasons of the year, when conditions are favorable as to temperature, etc.

The general belief among physicians that there is a malarial germ, is, perhaps, the reason for the somewhat numerous pseudo-discoveries which have been announced. The most recent of these is the Bacillus malariae of Klebs and Tomassi-Crudeli. These gentlemen, in 1879, made researches in the vicinity of Rome, as a result of which they announced the discovery of a bacillus which they believed to be the veritable malarial germ. The evidence upon which their claim was based was obtained by experiments upon rabbits. The writer, in 1880, repeated their inoculation experiments with material obtained from the swamps in the vicinity of New Orleans, and showed that the fever which results from such inoculations does not correspond with the typical malarial fevers of man, and is, in fact, simply a form of septicaemia.

Nevertheless the Bacillus malariae received considerable credit in this country and in Europe, and many physicians were disposed to place it in the category of demonstrated disease-germs. On the other hand, the claim of Laveran received comparatively little attention. Among those who presented evidence in support of the malarial germ of Klebs and Crudeli was Professor Marchiafava of Rome. This gentleman has since continued his researches with reference to the causation of the malarial fevers, and finds himself compelled to abandon the Bacillus malariae. Indeed, I found no one in Rome who any longer attaches faith to this alleged discovery. But as a result of very extended observations, made in association with Dr. Celli of Rome, Marchiafava now fully confirms Laveran as to the presence of an amoeboid organism in the blood of patients suffering from malarial fever. Similar testimony had previously been given by Richard, a French army surgeon, who had excellent opportunities for such researches at Philippsville in Algeria. Space will not permit me to give a detailed account of the researches of these gentlemen, or of the different forms in which the parasite is said to present itself. The accounts show that it differs from all disease-germs heretofore discovered, inasmuch as it does not belong to the bacteria, and is not even a vegetable parasite. It is an extremely minute amoeboid organism, which is found free in the blood, or in the interior of the red blood-corpuscles (Marchiafava and Celli), or attached to them (Laveran and Richard). In a certain stage of its development it possesses from one to three or four flagella, and is endowed with active movements. But all of the observers agree that this form is not very frequently encountered. Marchiafava and Celli only observed the flagellate organisms in four cases out of forty-two, in which the blood was carefully examined.

The accompanying figure is copied from the



Figs. 1–20 represent the changes in form which occurred in a plasmodium, contained in a red blood-corpuscle, during a period of twenty minutes. Figs. 21–27 give some other forms which the plasmodia, both with and without pigment, may assume. *Fig.* 28 represents a motionless plasmodium which is emerging from a red blood-corpuscle (the blood was examined after the attack of fever and the administration of quinine).

latest paper [1] by the gentlemen last mentioned, and represents the parasite as seen in the interior of the red blood-corpuscles.

As mentioned at the outset, the writer had ocular evidence of the presence of such an amoeboid organism in the blood of a patient suffering from a malarial fever, during a recent visit to Rome. Passing through the wards of the Santo Spirito Hospital with Dr. Celli, a case was selected

[1] 'Weitere untersuchungen über die malariainfection,' in *Friedländer's Forschritte der medicin*, Dec. 15, 1885.

which had not yet been subjected to medication, and in which a febrile paroxysm had just been inaugurated. A drop of blood from the patient's finger was brought directly under the microscope, and Dr. Marchiafava soon succeeded in demonstrating to me in a most satisfactory manner the presence, in several red blood-corpuscles, of the organism referred to. I saw the amoeboid movements very distinctly, and cannot doubt that the extremely minute, transparent, and apparently structureless mass which I was looking at was, in truth, a living organism.

The space at my disposal will not permit me to review the evidence in favor of the supposed causative *rôle* of this blood-parasite. It is evident that further researches will be required before this can be accepted as definitely settled; but I must call attention to the fact that all of the observers mentioned testify that granules of black pigment are frequently found in the interior of the parasite (figs. 26 and 27). Pathologists have long since recognized the presence of similar pigment in the blood and in various organs as a distinguishing characteristic of malarial disease; and it has been generally agreed that this pigment has, in some way, had its origin from the haemoglobin of the red blood-corpuscles. These, by some agency, are destroyed in large numbers during a malarial paroxysm. This has been proved by actual counting of the number of corpuscles in a given quantity of blood drawn before and after the paroxysms, and is made apparent by the rapidly developed anaemia which results from malarial attacks.

Marchiafava and Celli propose to call this organism Plasmodium malariae. Laveran has abandoned the name first suggested by him — Osciliaria malariae — for the reason that it might lead to the mistaken supposition that the parasite in question belongs to the Oscillatoriaceae, a family of confervoid algae: we are therefore at liberty to accept the name suggested by Marchiafava and Celli, until such time, at least, as the life-history of the parasite has been worked out, and its proper relations determined.

Finally, we may mention that Marchiafava and Celli report several cases in which they have been successful in producing characteristic attacks of malarial fever by injecting into the circulation of persons free from such disease a small amount of blood drawn from the veins of a patient suffering from a malarial attack. In these cases the presence of the blood-parasite described was verified in the blood used for the inoculation, and subsequently in the blood of the inoculated individual when he was seized with an intermittent fever as a result of such inoculation. It is also stated that the parasite disappeared from the blood under the influence of the administration of quinine, by which the induced malarial disease was promptly cured. GEORGE M. STERNBERG.

A TRADE-ROUTE BETWEEN BOLIVIA AND THE ARGENTINE REPUBLIC.

THOUAR, whose departure for a new exploration of the Pilcomayo we have already noted, announces his safe return and successful accomplishment of the work attempted. The party, comprising twenty-three men, and two officers of the Argentine army, and a volunteer, Mr. Wilfrid Gillibert, left Fotheringham on the 5th of October, and reached the locality called El Dorado, two miles above the rapids, Nov. 12. Several encounters with the Indians had previously taken place, but here the explorers came upon a perfect ant-hill of Tobas. There were over two hundred huts, and about fifteen hundred Indians, against whom a victorious combat was waged, the Toba chief falling early in the conflict. After the fight, the explorers remained in camp on the spot for six days, minutely examining the obstructions in the river, and making canoes, with which, on the 18th of November, they started down the river, reaching the Paraguay Dec. 5, after two months of great hardship. They lost one man killed, and three disabled by wounds or dysentery.

The object of the exploration was to determine the character of the obstructions to navigation reported by Major Feilberg, and therefore the possibility of using the Pilcomayo as a commercial highway between Bolivia and the Argentine Confederation. In brief, the conclusion reached by Thouar is, that the so-called rapids are not of a serious character, being composed of soft tertiary rock, easily removed, and, even as they are, not impassable; since Father Patiño ascended them with his boats in 1721, and safely reached the borders of Bolivia. The depth of the river up to this point, at low water, averages eight feet; and beyond it, nearly five feet, with a rise in flood-time of over twenty feet. There are comparatively few snags or sand-banks. The channel, in floods, is clearly marked by the lines of high trees which border it, even when the plains beyond the channel are flooded. The channel is about thirty yards wide, and the current averages two miles an hour. Steamers of two hundred tons, drawing not over two feet and a half of water, could ascend the river to the Bolivian mission of Solano at any stage of the water. On the strength of this favorable report, an international committee has been formed, composed of Bolivian and Argentine officials, engineers and capitalists,

to open the route to commerce. The boundary is to be determined, and then operations will commence at once.

The services of M. Thouar have been recognized by the Bolivian congress, which has voted him a gold medal, five square leagues of land, and thirty thousand francs, for the publication of his maps and reports. The Argentine government has promoted the officers of his escort, and given a month's extra pay to the private soldiers. The explorer himself will devote himself to the perfection of the methods projected for the promotion of commerce on the Pilcomayo.

SURFACE-COLLECTING ON THE ALBATROSS.

DURING the past year surface-collecting has been very successfully carried on by the fish-commission steamer Albatross, and not only have many additions been made to the surface-fauna off our coast, but, what is at least of equal importance, rare forms have been taken in numbers sufficient for detailed microscopic study.

The nets chiefly employed in this work are ten feet long and of half-inch mesh; their mouths are four feet in diameter. The outer two-thirds are lined with a fine webbing, and the end is closed by several turns of stout lashing put on with care, to protect these linings from strain. They are suspended from the swinging booms, and, five-eighths submerged, towed at the rate of two knots an hour; each net, under these conditions, straining nearly twelve thousand gallons of water per minute. They are not, of course, adapted to the capture of the smallest forms of life, for which purpose fine silk nets of much less diameter are employed.

As might be supposed, the amount of material taken in this way is large. When surface-life is at all abundant, surface-fish and the young of some bottom-fish, the mature and immature forms of crustacea, various pelagic forms of mollusca, and jelly-fish of all sizes, are represented in the average haul.

Perhaps special mention should be made of the capture of argonauts and of several species of file-fish (Balistidae). Argonauta argo has been taken a number of times clinging to gulf-weed; and a fine specimen of another species of argonaut was taken from the under surface of a jelly-fish, to which it tenaciously clung. Unsuccessful efforts have been made to bring in alive argonauts captured during the short summer cruises of the steamer from Wood's Holl, Mass.: perhaps failure was due to the change from the warm water of the Gulf-Stream region to the cold water inshore. In an aquarium these animals swim about with a slow, undulating, rhythmic motion, sometimes holding themselves poised for a while, and then, by a sudden turn of the siphon, darting with ease in any desired direction. When swimming, the expanded and partially transparent membrane of the dorsal arm adheres so smoothly to the side of the shell, that it requires close observation in a strong light to detect the fact that it is covered.

The file-fish is found under gulf-weed, and is captured when the ship slows down for dredging or sounding. A specimen of this fish three inches and a half long, together with a piece of drift-wood covered with barnacles (Lepas), was placed in an aquarium. It immediately began to prey upon the barnacles thus: holding itself in readiness, it waited for the intended victim fully to extend its cirri, which the fish then, by a sudden onslaught, seized, and, backing swiftly away, dragged the greater portion of the animal from its shell. The attack of the fish was not always well-timed, and, failing in its purpose, its solid jaws brought up with a sharp click against the closed shell within which the coveted morsel had safely retreated.

Science has already noted the fact that the electric light is an important aid in surface-collecting. A single Edison-light bulb protected by a wire cage, and furnished on the upper side with a shade, is lowered a few inches under water by an insulated cable, which is then made fast. Light, silk bolting-cloth scoop-nets, fastened to long bamboo poles, are held in readiness above the illuminated area. The larger part of the material collected by these nets, especially in shallow water, is composed of small crustacea and worms, which the light often attracts in swarms.

At Wood's Holl, small schools of herring (Clupea) frequented the lighted area to devour the sexual form of certain worms (Nereis limbata and N. megalops). A number of specimens of this fish were taken with flies improvised to resemble these worms. The argonaut has been captured under the light, probably by accident. Squids, however, appear in numbers, apparently allured from some distance. The flying-fish often swims sluggishly towards the light, its wing-like pectoral fins more or less extended on the surface of the water, and quite motionless. If startled, it rises instantly in the air, and disappears in the darkness like a frightened bird. When taken unharmed from the scoop-net, it exhibits a wing-movement like that of the humming-bird or sphinx-moth, and seems to demonstrate its claim to true flight.

With the abundant material for close structural

study secured by these combined methods, it is to be hoped that we soon shall be as well acquainted with the surface-fauna off our coast as we now are with the bottom-fauna.

JAMES E. BENEDICT,
Resident naturalist of the Albatross.

EARTHQUAKE OBSERVATIONS.

THE occurrence of an earthquake, although not such an uncommon event in this country as most people suppose, rarely finds observers alert enough to make observations which, when sifted of hearsay and ambiguity, contain facts of much value to science either as to quantity or quality. As a guide to the information desired, it would be well to bear in mind the list of questions adopted in the circular to be issued by the U. S. geological survey, as follows: —

1. Was an earthquake shock felt at your place on the day of , 18 ? (A negative answer is as important as an affirmative one.)

2. At what hour, minute, and second of standard time was it felt?

3. How long did its perceptible motion continue?

4. Was it accompanied by any unusual noise? If so, describe it.

5. Was more than one shock felt? If so, how many?

6. Which of the following measures of intensity would best describe what happened in your vicinity? No. 1. Very light, noticed by a few persons, not generally felt; No. 2. Light, felt by the majority of persons, rattling windows and crockery; No. 3. Moderate, sufficient to set suspended objects, chandeliers, etc., swinging or to overthrow light objects; No. 4. Strong, sufficient to crack the plaster in houses or to throw down some bricks from chimneys; No. 5. Severe, overthrowing chimneys, and injuring the walls of houses.

7. Do you know of any other cause for what happened than an earthquake?

This list was proposed by Capt. C. E. Dutton, in charge of the division of volcanic geology, with the advice of Profs. C. G. Rockwood, T. C. Mendenhall, W. M. Davis, and H. M. Paul. A negative answer to the first question, from an observer near the disturbed region, is of course valuable as showing the limits of the disturbance. The second question, as to the time, is the most important of all; and an immediate comparison of the time-piece used, with standard time at the nearest railway-station or elsewhere, is particularly desirable.

Experiments are now being made as to the best form of seismoscope for the use of selected observers, while more refined observations with seismograph and chronograph can of course only be undertaken where there are special facilities, as at regular observatories, etc.

GEOGRAPHICAL NOTES.

Uape Indians of the Amazon. — We derive from Henri Coudreau some interesting notes on the ancient race of Amazonian Indians known as the Uapè. These people are generally below the average height of Europeans, and their complexion varies from light brown to something like a chocolate tint. Their hair is black and smooth; with rare exceptions, reddish or even blond. They possess a personal odor almost as strong and disagreeable as in some Africans, but which is not due to want of cleanliness, as they bathe several times a day. Though quiet in their manners, they are very independent in their habits, and when intoxicated, which often occurs, are insolent, violent, and cruel. They have religious and secular festivals called respectively 'cachiri' and 'dabucuri.' These consist chiefly of dancing and indulgence in intoxicating preparations of coca, wild hemp, and other herbs, and ceremonial tobacco-smoking. The cachiri-drink is made in a canoe-shaped wooden vessel, around which both sexes dance in a sort of procession, each individual putting his right hand on the shoulder of the person preceding him. The line is led by the chief singing, while the rest join in a refrain. They are deceitful and perfidious, and do not hesitate to use poison against ememies. The drug is extracted from a species of arum, and, in small doses, produces death by anaemia and innutrition after a month or two: strong doses produce immediate insanity. Their food comprises game, fish, fruits, and manioc-farina; they are very fond of several sorts of large ants. Their houses are built of wood, long, with a door at each end, thatched, and accommodating as many as fifteen families under one roof. They are generally dirty and ill-smelling. The furniture consists of hammocks, pottery, trunks of Brazilian manufacture, and a variety of odds and ends, beside their weapons, nets, and baskets. At one side is a small shed, where the farina is cooked on a hearth. There is often a small flotilla of canoes belonging to the inhabitants. These people make excellent canoes, some of which are large enough to seat thirty people, and sell readily for a handsome price at the Brazilian towns. The most singular of their industries is that by which they obtain salt. A plant grows in the district of Carurù, a stout herb

a foot and a half high, which is pulled up and burned, and the ashes leached with boiling water. On this an abundant scum arises, which is removed and dried. This is the salt which, white at first, afterward becomes grayish. It is a little bitter, but replaces ordinary salt for all purposes. It is curious that such uncivilized people should have discovered such a process.

The newly discovered affluent of the Kongo. — The river traversed by Lieutenant Wissmann, to which reference was made in a late number of *Science* (vii., 160), proves, as we suspected, to be one long indicated on the charts, partly under the name of Ikelemba. It is called by Wissmann the Kassai, and at different points is named the Zaïre, the Maneme, and the Kwa. It receives near its mouth the waters of the Kwango and the drainage of Lake Leopold II. It has a navigable length of about four hundred miles through a rich region with many probably navigable branches. Hippopotami were very abundant, in some places obstructing canoe navigation; eighty-two were counted in one herd. The mouth of the Kassai does not indicate the importance of the stream, which is probably the reason why it has not sooner been explored. According to Lieutenant Wissmann, the commercial future of the whole Kongo state depends upon the construction of a railway from Vivi to the upper Kongo valley.

PARIS LETTER.

SINCE my preceding letter, some very interesting facts have been made known in different sittings of the Academy of sciences or other learned societies. But I must begin by repairing an omission in my last letter, and mention Professor Verneuil's paper concerning phthisis. As it is generally conceded at present that phthisis is a parasitical disease, M. Verneuil proposes that a fund be especially raised for the purpose of studying the Bacillus tuberculosis, to try and find out some scientific and methodical way of fighting this microbe. M. Verneuil's letter has been published in the *Gazette hebdomadaire* and in many other papers; but I do not think that much money has been yet raised. M. Verneuil is no micrographer, and has never studied any bacillus or bacterium. His idea is a very good one, but he is not the man, nor does his name carry the weight necessary to make the idea work a long way in the world.

At the last meeting of the Société de psychologie physiologique, I listened to an interesting note by MM. Richet, Ferrari, and Hericourt, concerning the way in which the handwriting varies according to the suggested mental states of hypnotized persons. For instance, if such a person is told that he is Napoleon, and asked to write a letter, he writes one, in a handwriting entirely different from his own, in which a graphologist easily recognizes the signs of a certain mental state which is generally supposed to have been that of Napoleon; when told that he is a miser, he writes in a close, short, economical handwriting, in the way misers write, according to graphologists; as a peasant, he writes in a drawling, ugly hand. The conclusion drawn by these gentlemen is, that graphology is a real science, and that its main features are correct, generally speaking. After all, there is nothing wonderful in the fact that handwriting can be and is influenced by the mental state, as is the case in physiognomy, attitude, and movements. The papers of MM. Richet, Ferrari, and Hericourt, will be published in the *Revue philosophique*, and their experiments are being continued.

A fortnight ago, the Société geologique began a series of conferences, to be held now and then at the ordinary meetings of the society. The opening address was made by M. A. de Lapparent, the well-known author of a very good book on geology, a text-book for French students. The subject was 'The form of the earth,' and M. de Lapparent communicated very interesting facts on the question. The most important, which is also the one that contributes the most to give to the earth a very irregular form, is the attraction which continents and even islands exert on water, as they do on the pendulum, resulting, as has been proved and measured, in an accumulation of sea-waters around continents. Thus the continents are all situated at the tops of hills of water; and to go from Europe to America, the ship has first to go down hill, then to cross a valley, and finally to climb another hill. Of course, this is an exaggerated figure; but, if the world were flat instead of round, the case would be exactly such as I have just said, for it has been calculated by some that between two continents the sea-level, in the middle, may be a thousand metres below the level the sea ought to have, and would have if there were no continents to attract it. As a curious and interesting confirmation of this attraction of seas by continents, it has been noticed that when Vesuvius is in eruption, and consequently when the mountain itself is denser on account of ascending and issuing lavas, the sea-level of Naples rises in a sufficiently well-marked manner.

M. de Lapparent, who does not think that there is any great motion in continents, and does not much believe in the sinking of some and the emersion of others, tries to explain the fact frequently met with, of sea-level and sea-beaches standing many hundreds of feet above the actual sea-level, in the following manner. Suppose a

large country without any ice at all, — no glaciers nor icebergs: the sea will take a given level around such a country. But suppose that for some reason or another this country gets covered with snow and ice, as is the case in polar regions: the sea-level will rise, because the continent will be denser, and will attract the sea with more force. But if half of the ice melt, the sea-level will be lower: if it melt entirely, the waters will re-assume their first level. We should then find on the seacoast three levels, — the actual one; one very high up, say a hundred yards; and another one halfway down. This explanation may perhaps be accepted for some countries, but it seems doubtful that it applies to all cases; and the theory of slow emersion and immersion of continents and islands — some of them, at least — cannot yet be overthrown. The conference of M. de Lapparent will be published in the Bulletin of the geological society, and a review of it is to come out shortly in *Nature*.

The principal event of the last month has been Pasteur's paper, read at the Academy of sciences the 1st of March, concerning the cure of rabies. The meeting was a very fine one. Some persons had heard it rumored that Pasteur was to speak, and to communicate very interesting facts, so the room was quite full. M. Gosselin, who had been sick for some time, came; and nearly everybody was there, except M. Chevreul, who was yet obliged to stay at home on account of the bad weather and a slight illness. M. Pasteur's note was a very long one, but it was listened to with great attention; and at the conclusion enthusiastic applause went up from every hand. M. Vulpian rose immediately after, and proposed that a vaccinal dispensary be erected for the purpose of admitting all persons bitten by rabid dogs, and having them cured by M. Pasteur and his assistants. The fact is, that it is necessary to be able to receive all persons, French or strangers, who desire Pasteur's assistance, and to have some sort of hospital. M. Vulpian's proposal was greeted with many cheers, and M. Pasteur quite approved it. The results of Pasteur's 350 first experiments on the cure of rabies in mankind are certainly very encouraging, and the subscribers are sending a good deal of money. Pasteur is sure to have all the money that is necessary, and will certainly use it well. He wishes to investigate now the question of diphtheria, and to try and find out the way of preventing or fighting it. It is to be hoped also that tuberculosis may catch his attention. Tuberculosis is far deadlier than cholera, diphtheria, and rabies put together.

Apropos of cholera, M. Rochefontaine, who was director of Professor Vulpian's laboratory, died a few days ago. It will be remembered that Dr. Rochefontaine tried last year an experiment on the etiology of cholera, swallowing a pill in which choleraic dejections and bacilli formed the prominent feature. He recovered, and some months ago he began again, in another manner, inoculating bacilli under the skin. It is, however, believed here that these experiments were very detrimental to his health, and that his sudden death, in the course of a very mild illness, may have been the consequence of them. Professor Vulpian made a very heartfelt and appropriate speech at the burial. Rochefontaine has been during seventeen years the *préparateur* and the assistant of M. Vulpian: he was, in fact, his only pupil, as concerns experimental physiology, and his death is a very serious blow to Vulpian, who will certainly not find so experienced an assistant to help him.

M. A. Gautier, the professor of organic chemistry in the faculté de médecine, pupil and successor of Würtz, has recently published a very interesting paper, read before the Academy of medicine, concerning ptomaines and leucomaines. Leucomaines are alkaloids very similar to ptomaines, but they are formed in the living body and during life, instead of developing after death. They are very poisonous. In the next letter, I shall perhaps be able to give more information on this point.

The Concours d'agrégation at the Medical school was finished yesterday evening at half-past six, after some two months' duration. The candidates who have been admitted are MM. Brissand and Ballet, two of Charcot's pupils, neither of the best nor of the worst; M. Dejérine, Vulpian's pupil, very well known by quite a number of papers and contributions on nervous pathology and physiology — he certainly is the best man of the four in the estimation of all, and is a very good recruit for the faculty; M. Chauffard, son of the well-known spiritualist professor, who died some years ago — he has no works to speak for him, being yet very young, but his *concours* was a very brilliant one. V.

PARIS, March 17.

NOTES AND NEWS.

On the 25th of March, 1826, Alvan Clark, the senior member of the famous firm of telescope-makers, was united in marriage to Miss Maria Pease, and the venerable couple are still living, the former at the age of eighty-two, and the latter seventy-eight. A reception was given in honor of the sixtieth anniversary of their marriage. During the past year Mr. Clark has painted three

large portraits in oil, — of his two sons, Alvan and George, and of a grandson. Portrait-painting was Mr. Clark's profession till he was forty years of age, when, by trying to assist one of his sons, then a student, in the grinding of a reflector for a telescope he was making for his own use, his attention was first directed to the grinding of optical surfaces as a business.

— Captain Eden of the British schooner Storm king, bound from Utilla to New Orleans, reports on Thursday, March 11, passing over a submarine mineral-oil spring, bubbling and rippling all around the vessel, and extending out over one hundred and fifty to two hundred yards. This was in latitude 25° 48′ north, longitude 86° 20′ west, about two hundred and fifty miles southeast of the passes. At 11 A.M. they were over the spring proper, and at 11.30 A.M. outside the circumference of the oil-circle. It is supposed that this spring is the oil-cargo of a foundered vessel, which, breaking through the casks, caused this peculiar marine freak, or that it may be a natural phenomenon.

— The *Railroad gazette* cites one of the longest times in which fire has been kept in a furnace without the addition of fuel. A furnace belonging to the Kemble iron and coal company at Riddlesburg, Penn., was banked up and hermetically sealed in November, 1884, fire being left in. On March 5, 1886, the furnace was opened, after being closed for nearly sixteen months. The fire was found to be still burning, the coke glowing brightly, and, on the admission of air, soon became hot enough to melt cinder. It was started as easily as if it had been standing but a week.

— A railroad company in southern Kansas has established a large artificial plantation of forest-trees to supply their future needs. Over a square mile of land near Farlington has been planted with young saplings of the catalpa and ailantus. The prospective success of their experiment has brought about the similar planting of another equal area. These trees are of rapid growth, and are valuable for ties and fencing-material.

— The first international congress of hydrology and climatology will convene the 1st of October next at Biarritz, and will last eight days. Communications and inquiries may be addressed to the Viscount de Chasteigner, at Biarritz.

— The March number of the Johns Hopkins university circulars contains abstracts of several scientific papers of value, read before the scientific and philological association of the university, as follows: 'Instantaneous photographs of the heart and intestines in motion,' by Dr. Thompson; 'On the antiseptic action of acids,' by Mr. Duggan; and on 'Speech mixture in French Canada,' by Mr. Elliott.

— The next volume of the 'Encyclopaedia Britannica' will be issued about the middle of this month. Among the principal articles will be 'Psychology,' by Mr. J. Ward; 'Railways,' by Messrs. D. K. Clark, A. T. Hadley, A. M. Wellington, and S. W. Dunning; 'Animal reproduction,' by Mr. P. Geddes; 'Vegetable reproduction,' by S. H. Vines; 'Reptiles,' by Dr. A. Günther and St. G. Mivart; 'Respiration,' by Prof. A. Gamgee: 'River-engineering,' by L. F. Vernon-Harcourt; and 'Roman topography and archeology,' by J. H. Middleton.

— The *k. k. naturhistorischen hofmuseum* at Vienna has begun the publication of *annalen*, under the editorship of Dr. Franz v. Hauer, the superintendent. The first number, lately issued, contains a report for the year 1885, which will be of interest to those concerned in the management of museums. The *personnel* of this important museum includes many names, such as Pelzeln, Rogenhofer, Fuchs, Brezina, Brauer, Marenzeller, Heger, Szombathy, and others, more or less widely known as eminent scientific men. Altogether the staff of curators, assistants, and servants, numbers forty-four. The next number will appear in May, and will contain zoölogical, botanical, and mineralogical papers by Steindachner, Kohl, Beck, Brezina, and others.

— A new enterprise of considerable importance is announced in Germany. It is the issuance of a *Handbuch der klassischen alterthumswissenschaft in systematischer darstellung,* which will deal with the entire field of classical philology and archeology, with especial reference to the history, method, and bibliography of the respective departments. The work will be complete in seven volumes, — of which three parts, comprising a volume and a half, have already appeared, — and is edited by Professor Müller of Erlangen, assisted by Professors Blass of Kiel, Brugmann of Freiburg, Busset of Kiel, von Christ of Munich, Hübner of Berlin, Jordan of Königsberg, Lolling of Athens, Niese of Breslau, Nissen of Bonn, Reifferschied of Breslau, Schiller of Giessen, Schanz of Würzburg, von Urlichs of Würzburg, and Windelband of Strasburg. This array of distinguished names ought to insure a work of great interest and value.

— We have received a translation into the German, of Auchincloss's well-known work on valve-gearing of steam-engines. The original was published by Van Nostrand in 1869, and a second edition in 1883. It has been a standard

treatise on the subject in this country, and, with Zeuner and Blaha in Europe, has given the engineer exceedingly valuable methods of treatment of all problems arising in the designing and adjustment of the slide-valve. The work, both of author and publisher, is well done; and our German friends are to be congratulated upon having so good a reproduction of what has long been considered in the United States, in many respects, an exceptionally valuable treatise.

— Mr. S. S. Bassler, of the *Cincinnati commercial gazette*, has lately published a timely little pocket-pamphlet entitled 'The weather chart,' in which he illustrates the types of areas of high and low pressure that cross our country, and control its weather, by small sketch-maps for recent dates, still in the minds of his readers. The object of the essay is a good one, and the examples are well chosen; but we regret that more care is not taken to secure accuracy in its explanatory statements. It is very questionable whether correct ideas can be gathered from such phrases as, "Could we go beyond the limits of the atmosphere, and look down upon its surface, we should see a constant succession of hills, valleys, plains, and areas of tempestuous cross-waves." It is true that in the lower atmosphere the imaginary isobaric surfaces would be thus deformed, in accordance with changes in temperature and density of air; but there is every probability that these irregularities are all smoothed out long before the limits of the atmosphere are reached. And it is to be regretted that one who has done so much good work in popularizing his favorite study should degrade its terminology by the frequent use of such words as 'high' and 'low,' instead of the better ones 'anti-cyclonic' and 'cyclonic systems,' which appear but a few times.

— Robert Oppenheim of Berlin announces a 'Führer für forschungsreisende' by Dr. F. v. Richthofen. This book is intended as a guide for travellers in making observations of interest in physical geography or geology. It is intended especially for those who, without special knowledge in those sciences, yet have some acquaintance with their rudiments.

— The following works of interest to scientific readers have been announced: 'Creation or evolution,' by George Ticknor Curtis (*Appleton*); 'Freshwater fishes of Europe, a history of the genera, species, structure, habits, etc.,' by H. G. Seeley (*Cassell*); 'Electric lighting,' translated from the German (*Cupples, Upham & Co.*); 'Can matter think?' by Elliott Coues (*Estes & Lauriat*); 'Geological studies,' by Alex. Winchell (*Griggs & Co.*); 'Builders' work and builders' trades,' by H. C. Seddon (*Lippincott*); 'Avoidance of collisions at sea,' by W. Bainbridge (*Van Nostrand*); 'The luminiferous ether,' by Volsen Wood (*Van Nostrand*); 'Evolution of to-day,' by H. W. Conn (*Putnam*); Anthony and Brackett's 'Text-book of physics' (*Wiley*); 'Arctic explorations in the nineteenth century, from Ross to Greely' (*Allison*); 'At home in Fiji,' by Gordon Cumming, new edition (*Armstrong*); 'Persia, the land of the Imans,' by James Bassett (*Scribner*); 'The Kilima-Njaro expedition, scientific exploration in eastern equatorial Africa,' by H. H. Johnstone (*Scribner*); 'What young people should know,' revised edition, by B. G. Wilder (*Estes & Lauriat*); 'A history of education,' by F. v. N. Painter (*Appleton*); 'A science of mind,' by J. H. Seelye (*Ginn & Co.*); 'The philosophy of wealth,' by J. B. Clark (*Ginn & Co.*); 'Our government,' by J. Macy (*Ginn & Co.*); 'General geology for high-schools and colleges,' by N. S. Shaler (*Heath*); 'Guides for science teaching,' four volumes (insects, fishes and frogs, birds, and mammals), by Alpheus Hyatt (*Heath*); 'Introduction to the study of philosophy,' by G. Stanley Hall (*Heath*); 'Modern petrography,' by George H. Williams (*Heath*); 'Industrial training,' by C. M. Woodward (*Heath*); 'A handbook of plant dissection,' by J. C. Arthur, C. R. Barnes, and J. M. Coulter (*Henry Holt*); 'The calculus,' by Simon Newcomb (*Henry Holt*); 'Elementary zoölogy,' by A. S. Packard (*Henry Holt*); 'Wood's medicinal plants,' American edition, by Charles Rice (*Wood*); 'The railways and the republic,' by James F. Hudson (*Harper*); 'Society, its peculiarities, practices, and problems,' by G. C. Lorimer (*Funk & Wagnalls*); 'Essays on finance, wages, and trade,' by R. Giffen (*Putnam*); 'Theism and evolution,' by J. S. Van Dyke (*Armstrong*); 'University education,' by G. S. Morris (*Andrews & Witherby*); 'Educational value of different studies,' by W. H. Payne (*Andrews & Witherby*); 'Mineral physiology and physiography,' by T. Sterry Hunt (*Cassino*); 'Methods of teaching and studying natural science,' edited by G. Stanley Hall (*Heath*).

— *The future* bears every mark that distinguishes publications of its class. The system on which its author, C. C. Blake of Richland, Kan., bases his "calculation of the coming weather through astronomical mathematics," is modestly entitled 'Cosmogony,' and in the April number of the paper its explanation goes so far as concluding that there is no such thing as matter, and motion only exists. By a vague series of inconsequences, it is shown that the earth is built up by gradual accretion of rays from the sun: "it is the gradual growth of the earth by absorption from the sun

that is the cause of the secular acceleration of the moon, which the best of astronomers have not been able to account for." The egotistical self-sacrifice that pervades the sheet is more pitiful than its teachings are dangerous.

— *The weather journal*, issued weekly at Cincinnati, by S. S. Bassler, the weather editor of the *Commercial gazette* of that city, is quite unlike most journals afflicted with meteorological titles in this country: it has nothing to say about cosmogony, or the influence of Saturn, but gains its high value from a set of twenty-one little maps in each issue, giving the isobars and something of the winds, temperature, and precipitation, three times for every day of the week of its publication, constructed according to the signal-service observations. Although too small to contain much detail, the maps show with sufficient clearness where the centres of high and low pressure are to be found, and the accompanying text is designed to explain the simpler principles of weather forecasting on this basis. We trust it may secure the large circulation that it well deserves, and that the maps may at the same time gain somewhat in clearness of execution in response to the requests of numerous subscribers.

— The first annual summary of observations made at the Blue Hill meteorological observatory, near Boston, was lately issued by Mr. Rotch. It contains a detailed statement of monthly and annual means, extremes, and ranges for 1885, placed side by side with similar records from the Boston signal office, ten miles north of, and five hundred feet lower than, the observatory. The mean annual values of several elements are as follows: pressure (reduced to 32°, sea-level and standard gravity), 29″.962 and 29″.964; temperature, 44°.4 and 47°.1: total wind movement 166, 110, and 102,829 miles; total precipitation, 39.00 and 46.85 inches. Mr. Rotch is contributing a series of articles on the mountain meteorological stations of Europe to the current numbers of the *American meteorological journal* that will prove of much value to students in this country, not only by informing them where high-level observations are made, but also by directing them to the publications in which they are recorded and discussed.

— The general detailed map of the United States, proposed and already begun by the U. S. geological survey, will be upon the scale of about four miles to the inch, with contour lines for every twenty-five to two hundred feet, according to the nature of the topography. It is proposed to issue this map in atlas sheets, each composed of one degree of latitude by one of longitude, bounded by parallels and meridians.

— The first number of the *International record of charities and correction*, edited by Mr. F. H. Wines, and published by Putnam's Sons, has been received. The *Record* aims to make popular the literature of the subject to which it is devoted, to interest the public in such questions, and to show "what progress is making in the struggle for the relief of human suffering, and the elevation of the race." The general subject which will be discussed in its columns is 'social evils, their causes and remedy.' The editor names as the five great evils with which humanity has to contend, poverty, ignorance, disease, vice, crime.

— A local hurricane at Murraysville, Penn., on March 21, which caused considerable damage to property, has been ascribed to the heat produced by the conflagration at the large gas-well there.

— The French consulting committee of hygiene, we learn from *Nature*, recently advised the prohibition of the use of vaseline for butter in food-preparations. The effects of vaseline on the system, however, seemed to require fuller examination, and Dr. Dubois has made some experiments in regard to it. Two dogs were fed exclusively on soup in which the usual fat was entirely replaced with vaseline: one of them absorbed twenty-five grams of vaseline a day for ten days; the other fifteen grams (this would correspond, in the case of an average man, to one hundred grams and sixty grams respectively). With this diet the animals even slightly increased in weight. Their general state was good: there was no loss of appetite, nor vomiting, nor diarrhoea. In general, it may be said that the carburets of hydrogen forming vaseline, though they favor neither oxidation nor saponification like fats, are readily tolerated in the alimentary canal, at least in the case of dogs. Further experiments will show if a prolonged use of the substance is equally innocuous.

— The report of Mr. Hodgson to the Society of psychical research, denouncing the theosophists and Madame Blavatsky, has been replied to, says the London *Graphic*, by Mr. A. P. Sinnett, in a pamphlet called "The 'occult world phenomena' and the Society for psychical research" (*Redway*). It is not, it does not indeed pretend to be, a complete answer to the many points raised by Mr. Hodgson. There is no attempt, for example, to explain the existence of the damning Coulomb letters. But Mr. Sinnett scores some points against his adversary, and his pamphlet is to be followed by some memoirs of Madame Blavatsky,

which may contain further refutations. Madame Blavatsky herself appends to the pamphlet a brief and indignant denial of the grave charges which have been made against her.

— The success of the U. S. fish commission has caused complaints in England of the negligence of that government in matters pertaining to the fishing interests. The *Athenaeum* states that at the present moment there is not in the three kingdoms one scientific naturalist employed by the government to whom it has the right to apply for information on fishery questions. It is now said to be the intention of the government, however, to form a new fisheries board or commission.

— Caustic lime, ground fine, and consolidated by a pressure of forty tons into cartridges two inches and a half in diameter, is used in some collieries for getting coal, where gunpowder would be dangerous. After the holes are drilled in the face of the coal, an iron tube half an inch in diameter, with a small groove externally on the upper side, and several perforations, is inserted the whole length of the hole. The cartridges, which have a groove to fit the tube, are then inserted and lightly rammed, and the hole tamped. A small force-pump injects through the tube a quantity of water equal in bulk to the lime. The water escapes through the perforations and along the groove, saturating the whole, and driving out the air. The tube is then closed by a tap to prevent the escape of the steam, which, by its force, cracks the coal away from the roof, and then follows the expansion of the lime.

— A system of irrigation is on trial in Colorado, in which the water is conducted through pipes, laid a little below the surface several feet apart, and having small holes at intervals on the upper side to permit of the escape of the water, which percolates through and thoroughly moistens the soil. The advantages are claimed, that the surface of the soil is not chilled by flooding, and that the ground is not subsequently baked by the hot sun.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Phylloxera.

WHAT evidence have we on the following points in regard to phylloxera? —

First, was it well known as a pest in this country before its introduction abroad?

Second, when and how did it reach Europe?

Third, why is it more injurious in Europe than in its native habitat? and

Fourth, is there any reason to suppose that the pest will be mitigated by natural causes as time goes on?

A. M. D.

New York, March 29.

Certain questions relating to national endowment of research in this country, and their importance.

I have read with interest Dr. Shufeldt's arguments in *Science*, favoring endowment of research, and the recognition on the part of the government "of those persons in her employ who have from time to time demonstrated their fitness to perform certain work," but I would like to ask the talented author why he would restrict this recognition to those in the government's employ. or why, indeed, there should be any distinction made between such men and other able men in civil life. The physician who finds that he is far better qualified for some other pursuit than that of medicine gives up his profession, and accepts a position where his talents can be better applied. Is not the same resource left for army officers? Dr. Shufeldt will hardly claim a monopoly of talent in government employ; then why are not the many struggling students of science in civil life who have shown evidence of their fitness to perform certain work equally entitled to recognition? By all means, if such a scheme is feasible, endow or assist original research, but put all citizens absolutely on the same level. While one may sympathize with the talented officers who are compelled to undergo wearisome drudgery not akin to their tastes or inclination, it cannot be forgotten that there are many other equally talented scientific men who have to struggle without even the assurance of a comfortable salary. Endow research, but let the endowment be impartial.

W. S. N.

New Haven, Conn., March 27.

The anachronisms of pictures.

Supplementing your recent publications touching the above-named subject, an example interesting to geographical botanists may be recorded among the existing curiosities of the national capitol.

The senate committee in charge of the fine arts has secured a picture representing a well-known incident in the life of Columbus, that occurred in old Spain anterior to the discoverer's first trans-Atlantic voyage. This picture is hung at the head of the marble stairway near the seats reserved in the senate hall for the ambassadors of foreign powers. It proclaims to the world that the plant (the Opuntia [cactus of Linneus] ficus indica, or prickly pear) which has figured in Mexican patriotic symbolism from time out of mind, and which holds the most prominent place in the oldest of Aztec legends, — the plant which Mexico regenerate has chosen as an emblem sanctified by association and antiquity, and has placed upon her banner and her dollar, — this senatorial picture proclaims that this cactus, so dear to the patriotic Mexican heart, is not originally Mexican, but that it was a possession of the usurper, and in pre-Columbian times grew by the dusty wayside in old Spain. That it had not reached Europe at the date of the incident represented in the picture, there can be no doubt.

I would refer the student to Alfonse de Candolle's work, 'Origin of cultivated plants' (*Appleton*, 1885), p. 275. Speaking of the Opuntia ficus indica, the eminent botanist says, "It was one of the first plants which the Spaniards introduced into the old world, both into Europe and Asia. Its singular appearance was the more striking that no other species belonging

to the family had before been seen." Should the student wish to investigate still further, he will find in de Candolle's treatise the names of several Spanish and other authorities. NOPAL.

New York, March 29.

Schwatka's Along Alaska's great river.

The author of the review of Schwatka's work on the Yukon (p. 294) is evidently ill-informed as to the history and present state of the mapping of that river, when he states that Raymond 'surveyed' it from Fort Yukon to its mouth, and supposes that the map of Raymond is the 'best in existence' of the lower Yukon. It is probable that he derives his impression from Schwatka's work; that gentleman, like many military men, preferring to ignore or affect contempt of any work done outside of military circles. The fact is, that Raymond's map has at present merely an historical value, and was originally merely one step in the many by which an approximate sketch of the course of that great stream has been arrived at. The first explorations were by the Russians, and are summarized in the map of Zogoskin, which, for the part included in it (except at the mouth of the river), has not been materially changed by any one, though positions have been better determined, and details added or subtracted. The river between the end of the Zogoskin map and Fort Yukon, and the delta, were mapped by the Western union telegraph expedition, whose work as to detail is fuller than any thing subsequent. They also sketched the upper river, but it was reserved for Raymond to correct the astronomical positions of important points, and thus modify the general course; to Schwatka and Krause, to furnish better details of the Lewis branch and head waters; to Nelson, to do the same for the delta, and Lieutenant Allen for the Tananah water-shed. The credit due to each cannot be monopolized by any man or set of men, and it does not impair any man's reputation to do justly by his forerunners.

WM. H. DALL.

Smithsonian institution,
March 27.

A swindler abroad again.

Please give place to an advertisement of a fraud who has just left Oskaloosa. He came on the 6th, remained six days, and left without having caused sufficient suspicion for any one to say any thing. He professes to be Prof. Henry S. Williams of Cornell university, N. Y., a captain on the retired list of the U. S. army, — retired for disabilities resulting from wounds received from the Indians three days after General Custer fell. He is now representing the Smithsonian institution as a sort of an examiner, looking after books and specimens deposited at different places. He also represents that Cornell has a fund which makes it possible for them to sell for fifty dollars a set of fossils equal to sets sold by Ward for eight hundred and fifty dollars, and that they only want five dollars cash to pay for boxing and labelling, the remainder to be paid from time to time in local fossils, for which reasonable prices will be allowed. He contracted two sets here, but received the five dollars on but one of them.

He is about five feet eight inches high, weighs about one hundred and forty pounds, carries his right arm as though stiff, wears a glove on that hand, has light-brown straight hair, mustache, blue eyes, a large head with prominent forehead, so that his eyes seem a little sunken, and uses tobacco and whiskey tolerably freely for a professional man. We *know* he has a whole right arm and hand, and it is quite possible nothing is the matter with it. He talks very freely and accurately of fossils, books, and men, can give minute details of events in Indian warfare of ten and more years ago, which some of our citizens know to be literally true. He spends his money very freely, and seems to have plenty of it.

There is a general feeling that he worked some one for one hundred and eighty dollars, but, if so, whoever it was will not tell it. The amount is indicated, because it is rumored he draws one hundred and eighty dollars per month from the army. I cannot find who started it. If he has not done so, he certainly missed a good chance. A despatch from Humboldt to the Des Moines *Register* says he has been there and got about one hundred dollars.

ERASMUS HAWORTH.

Penn college, Oskaloosa, Io.,
March 24.

Bancroft's History of Alaska.

In your review of Bancroft's 'Alaska,' published yesterday, you speak of the transfer of that region, and the surrender of the despotic sway of the Russian American company, only to be renewed by one of our own, or, to use your words, "while the monopoly which succeeded, though more confined in scope than that of the Russian company, does not differ in its essential details, and is still in operation."

The entire area of Alaska is to-day, and has been since the purchase, open and free to all comers, in so far as the fur-trade is concerned, with the single exception of that reservation of the government for the protection of the seal-life on the Pribylov Islands, in Bering Sea: these small islets are completely isolated, and far removed from contact with the trade of that region, and are practically unknown to everybody outside of their narrow limits, except the officers of the government and the employees of the A. C. Co.

Competing traders are found at every little post in Alaska to-day where the fur-trade will warrant the establishment of the smallest trader and his outfit. There never has been the slightest interference with the prosecution of the fur-trade in Alaska since 1867 by any monopoly whatsoever.

HENRY W. ELLIOTT.

Smithsonian institution, March 27.

[The statements of the above letter, in so far as they are accurate, are theoretically true: the statement of the reviewer, in his judgment, better represents the social and commercial facts, as regards the whole territory, except the small area about Sitka.—REV.]

Names of the Canadian Rocky Mountain peaks.

An error in my article, printed in *Science*, vii. No. 162, is kindly pointed out by Dr. George M. Dawson of the Canadian geological survey, which I am glad to correct for your readers. Dr. Dawson tells me that the peaks of the Rocky Mountains, Hooker, Balfour, Brown, etc., were not named by the botanist Douglas, as I stated, but by Dr. Hector, now in charge of the geological survey of New Zealand, who in 1857–59 was attached to Captain Palliser's expedition into the north-west. ERNEST INGERSOLL.

New Haven, March 25.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 2, 1886.

INDUCED SOMNAMBULISM.

THE activity with which the study of mental phenomena, and especially of hypnotism, is now being pursued, is remarkable. Constantly publications are being brought to our notice, dealing with these popular topics, either in a literary, an empirical, or scientific way. Among the last to claim attention is a little work[1] by Prof. H. Beaunis of the faculty of medicine at Nancy, who has attempted to apply to the study of induced somnambulism scientific experimental methods. His work deals with the question from both physiological and psychological points of view, and treats of both mental and physical conditions. The substance of his more important observations and deductions, in the concluding chapters, is here presented.

What is the mental state of the hypnotized person during sleep? Is the intelligence active, and are the thoughts of the subject engaged? Observations seem to show that there is an absolute repose of the thoughts, except when under the influence of external impressions. When a hypnotized subject is asked of what he is thinking, the response is nearly always, 'Of nothing.' There is a state of intellectual inertia, or, better, of intellectual repose, in accord with the physical aspect of the hypnotized person: the body is immovable, the features impassible, with a general expression of calmness and tranquillity rarely attained in ordinary sleep. There are evidently no dreams nor thoughts of any kind; for those subjects who recollect very well whatever has transpired in some previous like condition recall nothing of an hypnotic sleep during which there have been received no external impressions.

Thus, contrary to the opinion of many physicians, undisturbed hypnotic sleep may be regarded as more recuperative; and from the observations made, both by the author and Dr. Liébeault, a part of the therapeutic effects produced by hypnotism may be attributed to the beneficial character of the induced sleep. It is often asked whether, in ordinary sleep, the brain remains inactive, and many reasons have been given to prove the contrary. Facts, however, seem to show, that, when it is profound, the brain is really as inactive as in the induced sleep.

This inertia of thought is, however, only a conditional one in hypnotism: the merest suggestion, a single word pronounced by the hypnotizer, suffices to produce an activity that may be very highly developed, sometimes even more than in the normal state. The judgment of the hypnotized person is good, and in general he reasons correctly and logically. "That which is the most striking," says Dr. Liébeault, "is his power of deduction: whatever may be the result of his intellectual elaboration, his train of reasoning is logical and rapid." It seems, then, incorrect to consider the hypnotized person as an unconscious machine, incapable of reasoning and of judgment, as Pitres has done. It is true, he lacks the impelling motive; but impulsion once given, the intellectual machine is set in motion with more regularity and precision than in the waking state even.

The author says, however, that he has never observed the marvellous phenomena admitted by certain magnetizers, such as mental divination, second sight, prophetic powers, etc. The subjects were never able to divine the nature of an object enclosed in the hand, nor to tell one's thoughts, or events that had transpired unknown to them. In regard to predictions, the same was likewise true: a subject was never able to announce any event in advance in which the prediction was realized. A fact which the author has tested many times, and which seems to admit of no doubt, is that certain subjects are able to recognize by the touch, or at least without the aid of sight or hearing, the sex and approximate age of persons with whom they come in contact; and in many cases the subject was able to designate immediately, upon seeing persons unknown to them, the nature and location of maladies under which they were suffering. All such facts of hypnotism, however strange they appear, may be explained by an increased activity of the senses, by an excessive sensorial sensitiveness, such as is known to occur in the somnambulist.

There is one point of special interest in the mental state of the hypnotized person which the author examined with care. Will the somnambulist prevaricate or lie while in that condition? According to Pitres, certain subjects during the hypnotic state falsify voluntarily and knowingly; but such cases were never observed by the author.

[1] *Le somnambulisme provoqué, études physiologiques et psychologiques.* Paris, *Baillière*, 1886. 12°.

Sometimes they would refuse to reply to questions, or would hesitate in answering, but in no case did he ever know of their telling a downright falsehood. Were it possible to test those naturally vicious, the results might be different; and it would be of great interest to examine, in this respect, the professional criminal. The hypnotized person, in fine, is entirely open, not only in his actions, but also in his most intimate thoughts and sentiments: every thing appears — vices, faults, virtues, passions — with entire simplicity and the most complete *naïveté*.

One of the most difficult problems in induced somnambulism is that of the relation existing between the subject and the hypnotizer. No matter how profound the sleep may be, the subject understands all that is said to him by the hypnotizer, though he may not understand that which is addressed by the latter to a third person. This relation is established through any or all of the senses. Though the hypnotizer may use the utmost precaution not to reveal his presence in taking the hand of the subject, he will immediately be recognized, and the subject will obey the impressions conveyed. Should the subject's arm be raised, it will remain in any given position, though, if done by a third person, it will fall immediately inert. Let passes be made in his immediate proximity, either in front or behind, and the subject will recognize whether they are done by the hypnotizer or some strange person. Can this be attributed to a superexcitation of the tactile sensibility? One cannot say. If the subject is asked how he knows who it is that makes these passes, he invariably replies, that he feels him. A subject may be placed *en rapport* with a third person by the simple command of the hypnotizer, when he will obey him with the same implicitness.

In what, then, does this singular phenomenon of the relation between hypnotizer and hypnotized consist? Noizet and Bertrand, together with Dr. Liébeault, accept the explanation of this affinity or relation as the result of the attention given to the hypnotizer by the subject while being placed in that condition, and that it does not differ from that seen every day in ordinary sleep. A mother sleeping near the cradle of her child does not cease to watch over it, and, though insensible to the loudest tones, is conscious of the lightest cry of her infant. By this hypothesis the imagination of the subject produces the effect, and there is no special relation, physical or physiological, between hypnotizer and hypnotized. The subject, says Carpenter, is possessed by a preconceived conviction that one particular individual is destined to exercise upon him an especial influence, and that it is the effect of a predominant idea suggested, directly or indirectly, by the magnetizer himself. Persons who hypnotize themselves for the first time, and without placing their thoughts especially upon any one person, are apt to receive the impressions of any by-stander.

Although certain facts seem to substantiate these views, there are others which are not easily explained by them, and which seem to indicate some real relation between hypnotizer and hypnotized.

Any attempt to explain these varied phenomena, or to establish some general theory of induced somnambulism, is yet premature; nor will the solution of the problem be possible till the functions of the brain, and especially the physiology of natural sleep, are better known than they are at present. One may, however, seek solutions of particular groups of phenomena.

By many authors most of the phenomena are explained by the concentration of attention, — the concentration of thought. It is well known that the mind may exert a most remarkable power over the organism, controlling or producing the most lively sensations of pain, and even causing sickness or death; but attention or concentration gives no real explanation. According to Durand de Gros, the essential feature is the suspension of all mental activity, except in some one direction; and, as nervous force continues to accumulate in the brain, there results a nervous congestion. The direction of this force in any one particular course, or to any sensorial organ, augments the activity in an extraordinary degree.

This influence of the attention and the concentration of thought in the phenomena of hypnotism may be readily accepted, especially so far as they concern the sensations; but there are facts that are not easily explained by them. One may understand that a hypnotized person, under the influence of an immediate impression, may believe that he sees or hears an absent person; but how can the fact be explained that the subject will see or hear him at a certain time, a week or more distant, when he has been so told by the hypnotizer? Does the hallucination rest wholly in abeyance during these days, to re-appear at a fixed time? Has there been a concentration of thought during all this time?

There are also other facts that must be taken into consideration. How does concentration of thought cause certain physiological phenomena, such as variations in the beating of the heart, redness and congestion of the skin, the production of blisters, etc., which are known to occur in the hypnotic state? Neither the will alone, nor suggestions from without, seem to be sufficient to

explain them. There must be some modification of the cerebral innervation, a receptivity and an aptitude very different from those in the normal state.

A distinct and strong impression must be made upon the somnambulist in order to command his attention, — a nervous shock arresting the course of his thoughts. This cerebral shock, if it may be so expressed, seems to be the *sine qua non* of success: it produces a sort of cerebral modification, some particular unknown state, without which impressions can have no effect. It is of interest to inquire whether we do not find analogous physiological or pathological states. There would seem to be certain features of surgical shock following severe operations, and causing singular conditions of mental alienation, that are similar; and is there not also a resemblance shown in the condition of deep mental abstraction witnessed in some persons? The characteristic trait of all these different conditions is a momentary suspension, more or less complete, of cerebral activity. This suspension may present all varying degrees, from the profound collapse following surgical operation, to the simple mental distraction.

THE NATURE OF SO-CALLED DOUBLE CONSCIOUSNESS AND TRIPLE CONSCIOUSNESS.

There is a rather widely spread impression that human beings can be subjects of double consciousness, and can lead two separate lives, in each of which the individual has a distinct set of personal characteristics. Illustrations of this supposed psychological possibility are found in many recent works of fiction, notably in the 'Archibald Malmaison' of Julian Hawthorne, and 'Called back' of Hugh Conway. Some medico-legal interest has also been attached to the question in a number of instances. Having had one case somewhat of this character under observation, I have been led to examine the matter critically.

There are on record in French, German, English, and American medical literature only seventeen cases whose history in any way entitles them to come under the designation of cases of double consciousness. Most of them were reported from forty to sixty years ago, and without very great accuracy in detail. An examination of all these histories, and the study of cases allied to them, lead one very positively to the conclusion that such a thing as a true double consciousness, or dual life, does not exist. There are several striking instances in which persons have lived an apparently double life, but in each case the second life represented simply a partial activity of the patient's brain. In the second and morbid state a portion, viz., the higher volitional centres, have their activity inhibited, the mind is dull, the disposition apathetic, and memory of the past is gone. Indeed, this loss of the faculty by which stored-up impressions of the past are revivified is the main psychological feature of some cases.

In 1845 Dr. Skae reported the case of a lawyer, of whom he said, "He appears to have a double consciousness, a sort of twofold existence, one half of which he spends in the rational and intelligent discharge of his duties; the other, in a state of helpless hypochondriasis, almost amounting to complete aberration." His attacks occurred every other day. In the classical case reported by Azam, the patient, in one mental state, was dull, apathetic, and little better than an automaton, showing here, again, that it was a condition in which some of her mental faculties were suspended. A Kentucky farmer twenty-three years old was accidentally struck on the head with a hammer. He was unconscious for several hours, but recovered, and seemed as well as ever. He married, and had children, but, after eight years, began to show signs of insanity. He was trephined, and his mental faculties were completely restored; but the whole eight years since the blow on his head was a complete blank. He did not know his wife, or children, or any of his later associates. This was not so much a case of double consciousness, though so reported, as of loss of memory.

The theory that the two mental states correspond with special activity of one side or the other side of the brain, is not at all tenable, because, if for no other reason, one of the cerebral hemispheres may be almost entirely destroyed, or its connecting commissure may be injured or absent without producing any such phenomenon as double consciousness, or a change in personality. Besides, there have been at least two cases reported in which three different mental states occurred. One of them was recently reported by J. Voisin. A young man suffering from hysteria major had an attack of amnesia, or loss of memory, lasting for a year: there was entire forgetfulness of his past, a change in his character and demeanor. This state could be artificially changed into a third state by hypnotizing him, after which he would return to his second or abnormal state. After being restored to his normal mind for a year, he had another attack of amnesia, lasting three months, and during this time he remembered only what had happened in his previous attack.

States of double or triple consciousness are either disorders of memory, or instances of suspension of the higher volitional powers, being then cases of hypnotism or of the epileptic automatic

state. Double consciousness or triple consciousness never occurs in healthy people, but only in the hysterical, epileptic, insane, or in those who have had severe shocks or injuries to the head. Dramatists and writers of fiction should bear this in mind, if they wish to cling to the realities.

CHARLES L. DANA, M.D.

FOOD-ACCESSORIES: THEIR INFLUENCE ON DIGESTION.

THE results of experimental inquiries on the subject of foods and food-digestion, when scientifically conducted, cannot help being of great practical importance to man, so intimately is his physical perfection and intellectual activity dependent upon his alimentation. Among the results of certain experiments on this subject by Sir W. Roberts, as given in the *Nineteenth century*, the following will be found of interest.

Man, as the author says, is a very complex feeder: he has departed, in the course of his civilization, very widely from the monotonous uniformity of diet observed in animals in the wild state. Not only does he differ from other animals in cooking his food, but he adds to his food a greater or less number of condiments for the purpose of increasing its flavor and attractiveness; but, above and beyond this, the complexity of his food-habits is greatly increased by the custom of partaking, in considerable quantity, of certain stimulants and restoratives, such as tea, coffee, cocoa, and the various alcoholic beverages, which have become essential to his social comfort, if not to his physical well-being.

But the generalized food-customs of mankind are not to be viewed as random practices adopted to please the palate or gratify our idle or vicious appetite. These customs must be regarded as the outcome of profound instincts, which correspond to important wants of the human economy. They are the fruit of colossal experience, accumulated through successive generations. They have the same weight and significance as other kindred facts of natural history, and are fitted to yield to observation and study lessons of the highest scientific and practical value.

First, with respect to the action of ardent spirits on digestion, experiments were made with 'proof-spirit,' and with brandy, Scotch whiskey, and gin; and the conclusion is, that, so far as salivary digestion is concerned, these spirits, when used in moderation and well diluted, as they usually are when employed dietetically, rather promote than retard this part of the digestive process; and this they do by causing an increased flow of saliva. The proportion must not, however, much exceed five per cent; and gin seems to be less injurious than either brandy or whiskey. It was noticed in these experiments that both of these interfered with the digestive process, precipitating the starch more readily, altogether out of proportion to the amount of alcohol they contained, and brandy was worse than whiskey; and this circumstance appears to be due to certain ethers and volatile oils in them; and brandy contains a trace of tannin, which has an intensely retarding influence on salivary digestion. Even very small quantities of the stronger and lighter wines — sherry, hock, claret, and port — exercise a powerful retarding influence on salivary digestion. This is due to the acid — not the alcohol — they contain, and if this acid be neutralized, as it often is in practice, by mixing with the wine some effervescent alkaline water, the disturbing effect on salivary digestion is removed.

In the case of vinegar, it was found that 1 part in 5,000 sensibly retarded this process, a proportion of 1 in 1,000 rendered it very slow, and of 1 in 500 arrested it completely; so that, when acid salads are taken with bread, the effect of the acid is to prevent any salivary digestion of the latter, — a matter of little moment to a person with a vigorous digestion, but to a feeble dyspeptic one of some importance. There is a very wide-spread belief that drinking vinegar is an efficacious means of avoiding getting fat; and this popular belief would appear, from these experimental observations, to be well founded. If the vinegar be taken at the same time as farinaceous food, it will greatly interfere with its digestion and assimilation.

Effervescent table-waters, if they consist simply of pure water charged with carbonic acid, exercise a considerable retarding influence on salivary digestion; but if they also contain alkaline carbonates, as most of the table-waters of commerce do, the presence of the alkali quite removes this retarding effect.

With regard to 'peptic' digestion, the results are still more surprising. It was found that with ten per cent and under, of proof-spirit, there was no appreciable retardation, and only a slight retardation with twenty per cent; but with large percentages it was very different, and with fifty per cent the digestive ferment was almost paralyzed. It was also observed that the weaker forms of alcoholic drinks (wines and beer) differed greatly in the influence on peptic digestion from that of the distilled spirits. They retarded it altogether out of proportion to the quantity of alcohol they contained. Port and sherry exercised a great retarding effect. Even in the proportion of twenty

per cent, sherry trebled the time in which digestion was completed. It should further be borne in mind that this wine also retards greatly salivary digestion. Sherry, then, is injurious for persons of feeble digestive powers. With hock, claret, and champagne, it was also ascertained that their retarding effect on digestion was out of proportion to the alcohol contained in them; but champagne was found to have a markedly less retarding effect than hock and claret, due apparently to the mechanical effects of its effervescent qualities. The quantity of claret and hock often consumed by many persons at meals must exercise a considerable retarding effect on peptic digestion; but small quantities of these wines (and even of sherry) may not produce any appreciable retarding effect, but act as pure stimulants.

With regard to malt liquors it was observed, as with wines, that they retarded peptic digestion in a degree altogether out of proportion to the amount of alcohol contained in them; and, when taken in large quantities, they must greatly retard the digestion, especially of farinaceous food.

Tea, coffee, and cocoa were found to exert varying degrees of influence on the salivary digestion. The medium strength of the tea usually drunk is estimated at four to five per cent: strong tea may contain as much as seven per cent; weak tea, as little as two per cent. Medium coffee has a strength of about seven per cent, and strong coffee twelve to fifteen per cent; cocoa, on the other hand, is generally weaker, not more than about two per cent, and this may be one reason why it is more suitable to persons with feeble digestions than tea or coffee. Tea exercises a powerful inhibitory effect on salivary digestion, and this appears to be entirely due to the large quantity of tannin it contains; and, in order to diminish as far as possible its retarding influence on salivary digestion, it should be made weak and used sparingly, and it should not be taken with, but after, the meal. Coffee, unless taken in very large quantity, has very little retarding effect on salivary digestion: this is explained by the fact that the tannin of tea is replaced in coffee by a substance called caffeo-tannic acid. Cocoa resembles coffee, and has little or no effect on salivary digestion: the use of coffee or cocoa is therefore preferable to that of tea, for persons of feeble digestion.

With respect to the influence of tea and coffee on stomach digestion, it was found that they both exercised a remarkable retarding effect. There was no appreciable difference in the two beverages if they were of equal strength; but, as coffee is usually made of greater percentage strength than tea, its effect must ordinarily be greater. Cocoa also had much the same effect if used of the same strength as tea or coffee; but when of the strength ordinarily employed, its effect was inconsiderable. Strong coffee — *café noir* — had a very powerful retarding effect, and persons of weak digestion should avoid the customary cup of 'black coffee' after dinner.

Perhaps one of the most unexpected results of these experiments was the discovery that beef-tea had a powerful retarding effect on peptic digestion, as much so as that of a five-per-cent infusion of tea. Further researches appear to show that this retarding effect of beef-tea was due to the salts of the organic acids contained in it. Beef-tea contains but very little nutritive properties, and must therefore be looked upon rather as a stimulant and restorative than as a nutrient beverage, but it is nevertheless very valuable on account of those properties.

The author holds the view, that, in healthy and strong persons, the retarding effect on digestion, observed to be produced by many of the most commonly consumed food-accessories, answers a distinctly useful end. They serve, he maintains, the purpose of wholesomely slowing the otherwise too rapid digestion and absorption of copious meals. A too rapid digestion and absorption of food may be compared to feeding a fire with straw instead of slower-burning coal. In the former case it would be necessary to feed often and little, and the process would be wasteful of the fuel; for the short-lived blaze would carry most of the heat up the chimney. To burn fuel economically, and to utilize the heat to the utmost, the fire must be damped down, so as to insure slow as well as complete combustion. So with human digestion: our highly prepared and highly cooked food requires, in the healthy and vigorous, that the digestive fires should be damped down, in order to insure the economical use of food. We render food by preparation as capable as possible of being completely exhausted of its nutrient properties; and, on the other hand, to prevent this nutrient matter from being wastefully hurried through the body, we make use of agents which abate the speed of digestion.

These remarks will apply, however, only to those who possess a healthy and active digestion. To the feeble and dyspetic any food-accessory which adds to the labor and prolongs the time of digestion must be prejudicial; and it is a matter of common experience that beverages which in quantity retard digestion have to be avoided altogether by such persons, or partaken of very sparingly.

DEATH-RATE AND SANITATION IN RUSSIA.

A SERIES of admirable articles on vital statistics and the importance of sanitary measures is now appearing in one of the St. Petersburg daily papers, says the *Lancet*, founded on a paper by Dr. Eck. The statistics given are certainly of a nature to set every one in Russia thinking seriously about taking measures to improve them. Thus for the year 1882, which seems to be the last year whose vital statistics are available, the mortality in the ten southern provinces was 2.6 per cent; in the seven eastern provinces, 3.9 per cent; in the thirteen middle provinces, 6.2 per cent; in the sixteen western provinces, 3.1 per cent; and in the fourteen northern provinces, 3.7 per cent. After mentioning the various sanitary improvements called for, as drainage of various kinds, a supply of wholesome drinking-water, attention to and regulations about buildings of all descriptions, and the establishment of infectious hospitals, Dr. Eck goes on to say: "There is no need for us to puzzle ourselves how these matters are to be done; England has accomplished so much, that we need simply adapt what is ready to our hands to our own circumstances. In Germany, France, Austria, and Italy, steps are already being taken in the same direction, and all these countries take England as their chief model, so that we need not be ashamed to do so too." He then appeals to the economic importance to Russia of a reduction of the mortality.

On the principle of example being better than precept, he goes into a long but easily comprehensible calculation of the comparative working-value of horses whose ages at death vary; and he then takes the respective death-rates of Russia (35), Germany (27), and England (19), and, by means of a method of computation unusual amongst British statisticians, explains that they show that an Englishman has 53 years of life, while a German has 37, and a Russian 29 only. Reckoning a man's working-years to commence at the age of 18, an Englishman has 35 years in which to earn, against the Russian's 11; and the latter will probably not save much more in his 11 working-years, above what it costs him to live, than has been already expended upon him during his 18 unproductive years; but an Englishman will have 24 years more in which to go on earning and saving. Again, out of 1,000 inhabitants in Russia, only 373, or 37 per cent, are of an age to earn, while in England there are 660, or 66 per cent; or each individual of working-age in Russia has to provide for two non-workers, while in England he has only half a non-worker for whom to be responsible.

MUIR'S THERMAL CHEMISTRY.

THE recognition of the dual character of the phenomena involved in chemical operations is no new thing; but it is only of late that the attempt has been made to determine the relationship between transformations of matter and concurrent changes of energy, and the efforts to this end have been made almost wholly in the direction of thermal phenomena, — in the investigation of the quantities of heat which enter or leave a chemical system during the transition between accurately defined initial and final states, in a so-called chemical change.

Mr. Muir's presentation of the condition and aims of the thermal chemistry of to-day is opportune. Based as a matter of necessity upon the researches of Thomsen and Berthelot, it fairly bristles with references to the works of these masters, and, indeed, to all original papers of importance in the discussion of the subject. Following an outline sketch of the theory of energy and the molecular hypothesis, the author discusses successively the methods of thermal experimentation and their application to the phenomena of allotropy; isomerism; the neutralization of acids by bases, and bases by acids; the relative avidity (as Thomsen terms it) of acids; the classification of elements and compounds in accordance with thermo-chemical properties; the phenomena of melting, boiling, evaporation, dissociation, solution, and hydration; and, finally, the chemical interpretation of thermal data. Only such facts as are immediately of use for purposes of illustration appear in the body of the book; but all well-established data of the subject (excepting such as relate to boiling and melting points and specific heats, for which reference elsewhere is made) are to be found in the five appendices, which comprise a third of the matter between the covers of the volume.

The work is for the most part independent in opinion, and, with no pretence to exhaustiveness, sufficiently full for the purposes of the general reader, and quite intelligible to one acquainted with the elements of general chemistry and modern ideas of energy. Facts are presented fearlessly and as separate as may be from the constraint of theory, and the explanation is fitted to the facts.

The stumbling-block in the way of the interpretation of thermal values is the difficulty, often the impossibility, of determining what portion of a thermal change is of chemical origin, and what is physical; and it is not surprising to find the use

The elements of thermal chemistry. By M. M. PATTISON MUIR, assisted by David Muir Wilson. London, *Macmillan*, 1885. 8°.

of thermal relations in the matter of classification regarded as only supplementary, and even the 'law of maximum work' degraded to a mild assertion of the general probability of the occurrence, under physical conditions as nearly constant as possible, of that one of conceivable operations which shall evolve the greatest quantity of heat. Fortunately in the measure of relative affinities the effect of physical disturbance is at a minimum; and it is on this line that the author predicts, and rightly, as it seems, the surest advance. Mr. Muir has laid his audience under obligations; and, in view of the excellence of the work, some few depreciatory (perhaps quixotic) references to the baleful influences of structural chemistry and the bond theory will doubtless be passed over lightly.

NEW YORK AGRICULTURAL EXPERIMENT-STATION.

THE fourth report of the New York experiment-station contains the results of a vast amount of work upon various branches of agricultural inquiry; and, if the first impression which it makes is of a certain vagueness and lack of definiteness in its conclusions, a further study shows that much of this effect is due to the magnitude of the problems attacked, and the consequent incomplete character of the work at present.

As in former years, the work of the station has been largely botanical and horticultural in its nature, although other subjects have also received considerable attention, particularly stock-feeding and related subjects.

The work of the chemist upon the relative volume of the fat-globules in milk from different sources, and upon the structure of these globules, is full of interesting and suggestive results. By means of an ingenious method of his own devising, he has been able to determine microscopically the number of fat-globules in a given bulk of milk, and, by combination with the results of chemical analysis, their average volume. By this method he has shown, that, when milk is churned at a temperature above the melting-point of butter-fat, the number of fat-globules is increased: in other words, the fat-globules can be divided. He has thus, it would seem, disposed finally of the theory of a membrane surrounding the fat-globules, and completed the proof that milk is an emulsion, and behaves essentially like any other emulsion.

Fourth annual report of the Board of control of the New York agricultural experiment-station, for the year 1885; with the reports of the director and officers. Rochester, N.Y., *E. R. Andrews, pr.*, 1886. 8°.

But it is on the botanical and horticultural sides, as already intimated, that we find the greatest amount of work expended, and the most comprehensive plan of operations. There are, among other things, a botanical description and provisional classification of forty-three varieties of wheat, and a description of the leading varieties of lettuce (eighty-seven in number, according to the station's classification, and gleaned from at least two hundred differently named lettuces by the labor of three seasons). There is also a description of the products of a hundred and forty-eight varieties of maize, planted under such conditions as to insure extensive cross-fertilization, and tending to show that the variations thus produced can be referred to named varieties. All this, it will be observed, is in the line of agricultural botany; and the report contains the records of a large amount of other work, with many species of plants which may sooner or later be available in the same direction.

We shall watch with interest this attempt to reduce to system the present chaos in the nomenclature of agricultural varieties. The director of the New York station is confident that these varieties are much more persistent than is usually supposed; and, in the interest of both science and practice, it is to be hoped that his confidence will be justified by the outcome of his own and his assistant's labor.

The report of the botanist deals largely with plant-diseases, the most interesting portion being the demonstration that pear-blight is due to the activity of a bacterium.

The student of agricultural science may be inclined to regret the time which has been spent upon numerous side-issues and single experiments of no scientific value, and to wish that the large resources of the station had been expended in more extended and thorough scientific work upon a few problems; but he will not forget that a public experiment-station is not a purely scientific institution, but has duties to the man of practice as well, which are often best subserved by experiments, in which the purely scientific man can see no value. We have before now taken occasion to express freely our belief in the greater ultimate value of scientific investigation; but we desire to record also our appreciation of the value of carefully performed and conscientiously reported 'practical' or 'empirical' experiments, such as are to be found in this report. The New York station appears to us to be doing excellent work in both directions, and it is to be hoped that the liberality of the state in providing means for its prosecution will serve as an incentive to other commonwealths.

MINOR BOOK NOTICES.

Climatology and mineral waters of the United States. By A. N. BELL. New York, *Wood*, 1885. 8°.

THIS is a work intended especially to present ascertained facts so as to render them available for the promotion of health. In addition to a full and readable discussion of the different meteorological agencies and factors, the author deals with the climatological topography of the different regions of the United States, with weather reviews, and descriptions of the different medicinal waters. To the invalid the work will have its greatest, and we believe a real, value; but to all who are interested in the influences of climate upon health, or even in general meteorology, it will be found very useful. The author arrives at the conclusion that no country in the world possesses a greater variety of climate or climates with a higher degree of salubrity than the United States.

Statics and dynamics for engineering students. By IRVING P. CHURCH. New York, *Wiley*, 1886. 8°.

THIS book, so far as one can judge from the contents, since there is no preface, is intended for use as an elementary text-book in theoretical mechanics by students who are to get elsewhere a good deal of practice in solving problems, and some additional instruction. The text is, on the whole, very clearly written, the diagrams are excellent, and the illustrative examples cannot fail to interest the reader as well as to instruct him. The use of the phrase 'square second' instead of 'per second per second,' in such expressions as "an acceleration equal to 32.2 feet per square second," will probably be new to most engineers. The few typographical errors which we have noticed in text and formulas are not misleading, although the insertion of the few words which have evidently fallen out of the last paragraph on p. 18 might help a beginner.

Drainage for health; or, Easy lessons in sanitary science. By JOSEPH WILSON. Philadelphia, *Blakiston*, 1886. 8°.

THIS is a revised edition of a work on drainage, house-plumbing, etc. It is written in quaint, laconic style, and impresses the reader with having been prepared by one of pronounced opinions. In some parts it is excessive, and as a literary model can hardly be recommended; nevertheless it contains some very good advice and instructions.

De la désinfection des wagons ayant servi au transport des animaux. By Dr. PAUL REDARD. Paris, *Doin*, 1885. 8°.

THIS is a work that should be of service in America, where the questions of cattle transportation have frequently been of no little importance. The work treats of the danger of transportation of diseased cattle in railroad-cars, with evidence of the diffusion of epizoötic diseases from such. It gives also the principal European laws regulating the disinfection of cattle-cars with the comparative values of the different means employed. The author concludes that the various chemical agents, such as phenic acid, chloride and sulphate of zinc, sulphur, etc., are inefficacious. The results obtained by superheated steam (230° F.) were constant and successful. He describes methods by which disinfection may thus be accomplished with speed and certainty.

Mechanical integrators, including the various forms of planimeters. By Prof. H. S. H. SHAW. New York, *Van Nostrand*, 1886. 24°.

IN this convenient little book we have a systematic presentation of the principles on which mechanical integrators and the various forms of planimeters are based. The divisions of the book are as follows; planimeters in which slipping of the measuring roller takes place; planimeters in which only pure rolling motion is assumed to take place; moment planimeters; continuous integrators; limits of accuracy of integrators, both theoretical and experimental. Many forms of these instruments are described, and a host of inventors named from all countries. Among them Professor Amsler still holds the first place for the variety of his inventions, and their adaptability to a wide range of calculations, — to finding areas, average pressure on indicator diagrams, centre of gravity, contents of embankments, etc. From his works at Schaffhausen, more than twelve thousand polar planimeters have been sent out. This paper was originally presented before the Institution of civil engineers, and the report of the discussion that followed it contains many interesting practical points with reference to the use of these instruments. As the importance of such mechanical aids in calculation is becoming more and more felt, a book like this is useful and welcome.

IT is not often that a well-known scientific man has the melancholy pleasure of reading obituary notices of himself, as appears to have been the case with Dr. J. Jacob v. Tschudi, the South American explorer. *Natur* now corrects the error by stating that it was his brother, Friedrich von Tschudi, who died at St. Gall, Switzerland, on Jan. 24 last. Friedrich, though less known to American readers, did much good work in natural history of a popular or general character, the most important of which was his '*Thierleben der Alpenwelt*.' He was nearly sixty-four years of age. J. J. v. Tschudi, though four years his senior, is still actively engaged in research, as the frequent papers from his pen attest.

SCIENCE.

FRIDAY, APRIL 9, 1886.

COMMENT AND CRITICISM.

THE RISE AND FALL of the waters in the northwestern lakes, and the consequent dangers to the lake cities, have frequently been a sensational subject for discussion. The great tidal waves, like the one which rolled in on Cleveland a few years since, and the piling-up or lowering of the waters by continued gales, are, of course, real dangers on account of the suddenness of their occurrence, though, happily, they are rare and temporary events. But alarmists are continually announcing the discovery that the gradual or secular changes in the lake-levels are sure to bring disastrous results. According as the waters are rising or falling, we hear of grave fears that some lake-post is likely to be inundated, or left high and dry inland. Recent reports in the daily press indicate that Lake Michigan is assuming a threatening attitude towards Chicago and its suburbs. The lake is now rising, the reports state, at the rate of several inches per year; and one needs only to imagine this rise prolonged at the observed rate for a few years to get an idea of startling possibilities for the Garden city. But the records of the fluctuations in water-level of the Great Lakes, which have been carefully kept for many years by the corps of engineers, U.S.A., do not warrant us in prolonging any observable rise or fall indefinitely. On the contrary, these records indicate that the variations in the lake-levels, above or below the mean stage, are confined to a very few feet, — about three feet at the most. The variations are greatest in Lake Ontario, less in Lake Erie, still less in Lakes Huron and Michigan, which form a single level surface, and least of all in Lake Superior. With reference to Lake Michigan in particular, a glance at the water-level curves published in the report of the chief of engineers, U.S.A., 1882 (the curves do not appear to be published in the later reports), shows that the average yearly variation in level of that lake is about one foot, that the maximum variation during any one year included in the period (1859–82) covered by the published record was two feet and a half, and that the extreme fluctuation during the same period from the highest stage (in 1859 or 1876) to the lowest stage (in 1869 or 1873) was three feet and seven-tenths. The highest recorded stage of Lake Michigan, viz., that of 1838, was only one foot higher than the stage of 1859 or 1876. It seems tolerably safe, therefore, to conclude that the prospective dangers to Chicago or any of the lake cities from too much or too little water in the lakes are all such as may be overcome by acts of congress in the shape of timely items in the river and harbor bill.

No. 166. — 1886.

THE OUTLINE-MAP of the United States in four sections, prepared by Dr. A. B. Hart of Harvard, and lately issued by D. C. Heath & Co., may be a means of leading the numerous teachers of history throughout the country to adopt more scientific methods of instruction. On this account alone, and wholly apart from its intrinsic excellence, it deserves recognition and notice. The map is in four sections, each thirty-one by forty-four inches, the United States being divided at the 37th parallel and at the 95th meridian. Being in outline, and showing the principal water-courses, a skilful teacher can, without any great ability as a draughtsman, color the map so as to present in graphic form geological facts or the course of political and social development. Changes of population, the local strength of political parties, the distribution of railways, schools, or industrial establishments, topographical features, — in short, any thing which admits of statistical and graphic presentation, — can be shown with a minimum of expense and labor. The map is so cheap that a teacher can easily procure a number of them; and, when once colored to illustrate any particular subject, they can be rolled up, and used again at any future time.

We would suggest that the principle here applied by Dr. Hart to United States geography and history will bear extension. The map should be reproduced on a smaller scale for the use of pupils; for, by copying the display-map on an outline of his own, the facts will be more deeply impressed upon the student's mind, and he will always have a graphic summary of them for reference. We shall soon hope to see outline-

maps of Europe on the same plan. Nothing could throw more light upon the mazes of mediaeval and modern French, and particularly German history, than such a method of illustration as is here offered. Where the pupil now possesses an unmanageable congeries of facts, names, and dates, he could then carry away with him a vivid picture of the intricacies caused by the constant series of wars and dynastic contests. These maps are virtually the object-method applied to history, social science, geology, ethnography, and their related sciences. They are in every way commendable, and no teacher of those subjects should fail to apply the method which they suggest.

ALTHOUGH SENATOR ALLISON'S commission which is investigating the surveys reported the evidence taken some weeks since, no conclusions have yet been made public. Nothing officially authenticated can therefore be said as to what legislation the commission will finally recommend. But those who have most closely followed the proceedings, and watched the effect of the evidence upon the minds of the members, feel entire confidence that no very radical measures will be proposed, and especially that the integrity of the coast survey will not be threatened. It is scarcely believed that the commission will even recommend its transfer to the interior, or any other department than that under which it is now placed. The impression that no change will be made has become so wide-spread, that candidates for the position of superintendent are again coming forward. The friends of Gen. W. F. Smith are said to be the strongest, but it is not well to predicate any thing upon newspaper reports of the prominence of Smith, Rosecrans, or any other candidate. It is safe to say that the President is fully conscious of the importance of the position, and of the small value to be attached to recommendations secured by the candidates themselves. We believe that he will make the best selection he can from the names presented to him, disregarding their influence, and that the standing of the candidates as scientific experts will not be disregarded in the choice.

ELECTRIC RAILWAYS.

AMERICA seems to lag very much behind Europe in the matter of electric railways. Indeed, our lighting systems seem to have absorbed all our energies; and perhaps the most appropriate and lucrative use of dynamic electricity, its application to locomotion, has been overlooked, or been treated in so superficial a manner as not to have resulted in commercial success.

Every American supposes himself capable of intuitively doing his own engineering, regardless of the fact that he may have neither experience in any of its various departments nor education in the fundamental facts and methods of computation of technological application of scientific truths. Inventors with good ideas regarding electrical work gravely spin for us complete systems for electrical railways, drawing only on their intuitions for every thing save the dynamos and motors. Do they realize that a vast number of problems of organization and system still remain unsolved upon the steam-railroads? Do they realize that they are not engineers, but only electricians, with a vast deal yet to learn in their own field? They do not: they are in possession of one good idea, and they recklessly proceed to surround their invention with all sorts of engineering crudities, thus rendering their chances of success almost nothing.

Germany has been more fortunate in having its first electric railway undertaken by Siemens & Halske. This firm brought to bear upon the problem the profound researches and the engineering education of its staff, and, acting in the cautious and thorough manner resulting from its wide experience in many fields of engineering, has been successful. In the exhibition of Berlin, 1879, they established a circular railway of 350 metres length, one metre gauge, and, placing a three-horse power motor in a car capable of carrying thirty people, transported passengers at a rate of fifteen to twenty miles per hour. The current was taken along one rail, and by an insulated tire was conveyed to the positive pole of the motor, and thence to the other rail, by which it returned to the generating-dynamo. No special care was taken to insulate the rails, which were placed high above the ground on wooden ties. The current was of low electromotive force, and therefore did not require special means for insulation. This road was exhibited in Düsseldorf and Brussels, and finally in London in 1881.

The success of this experimental plant was uniformly so great as to make Messrs. Siemens & Halske desirous of building an elevated electric railway in Berlin, for which the plans and estimates were made with great care, but unfortunately this enterprise was not carried out, because the Emperor William would not permit 'The Linden' to be marred by being crossed at one point, and because the citizens objected to having people looking into their second-story windows.

The carefully made estimates of this road may be of interest as showing the minimum of cost of good work, upon the authority of engineers thoroughly conversant with their profession.

ELEVATED RAILWAY IN BERLIN, ONE METRE GAUGE, 6¼ MILES LONG, WITH SEPARATE MOTOR FOR EACH CAR.

Railway structure and 10 stations		$305,000
10 carriages, seating 15 persons each		15,750
Steam-engine, boilers and dynamos		9,750
Buildings		5,925
Land		22,500
General labor		8,575
		$362,500
Current expenses.		
Wages	$10,950	
Fuel	5,550	
Oil and waste	250	
Lighting	400	$17,150
Depreciation and repairs: —		
8% on $312,500	$9,875	
16% on $25,000	4,000	13,875
Interest on capital ($377,500) @ 5%		18,875
		$49,400

It was proposed to run two hundred trips each day at a fare of two cents per mile, and would have proved a paying investment had it obtained the equivalent of six passengers for a whole trip for each car.

Failing in this, Messrs. Siemens & Halske obtained a charter for a surface electric railway from the Berlin military academy to Lichterfelde, a distance of a mile and a half, which was opened in May, 1881. This road was constructed upon the ground after the manner of ordinary roads, save that a bowed fish-plate connected the rails so as to permit contraction and expansion. Again, only two rails were used, — one conveying the current out from the dynamo, and the other returning the current to the dynamo. Very little resistance was found, owing to the large cross-section of the rails used as conductors, and consequently low potentials were found practicable. Very great success has attended the running of this road, and it has been extended to Tetlow and Potsdam, making, in all, some eight miles of road in successful operation upon ordinary roadbed with wooden ties and steel rails. Insulated wheel-tires are used to take off the current.

At Paris the law required flat tram-car rails, not projecting above the street-level; and the presence of dirt would have interfered with the passage of the electric current from the rails to the wheels: so overhead copper conductors, and trolleys running along the conductors, and connected to the car by flexible wires, were used. In the mines at Zankerode, Prussia, Messrs. Siemens used two overhead rails for conductors, as the condition of the track prevented its use. A separate motor, weighing a ton and a half, drew loads of eight tons at a rate of seven or eight miles per hour. In other cases, Messrs. Siemens & Halske have found it advisable to use a third rail, or separate copper conductor connected with the positive pole of the generating-dynamo, and have connected the negative pole with one or both rails of the roadbed. The Portrush and Bush mills electric railway, six miles long, has used a third rail so placed as to be free from dirt, and has been in successful operation for several years. Besides the Portrush railway, there are now in successful operation electric railways at Brighton and Blackpool. Dupuy, at Lisieux, France, has arranged a locomotive for use in the bleaching-fields of a bleaching-works. The power is carried in Faure accumulators on the locomotive. Recently we have the experiments upon the Reckenzaun secondary battery tram-car at the Antwerp exhibition, which proved itself the superior, in many ways, of the steam and compressed-air motors entered in competition with it. When we compare the indicated power of the engine charging the secondary batteries with the power developed in moving the car, we find an efficiency of from thirty to forty per cent in this case. It is impossible to doubt the ultimate success of electric railways when built with sufficient knowledge and engineering skill to assure their adaptation to the purposes which they must subserve. The successful outcome of the work of Siemens & Halske prove this beyond a doubt. The possibility of attaching a motor to each car enables us, with very little loss of space, to have each car independent of any separate locomotive, and to utilize the adhesion of all the wheels, and load. The counter electromotive force of a dynamo used as a motor, being proportional to its speed, renders it to a certain extent automatic; so that, being at rest, the current passing is the most intense, the torsion is a maximum, and the car starts with a great pull. If the car slows on an up grade, the pull at once increases, and, if it goes faster on a down grade, the counter electromotive force increases, the intensity of the current diminishes, and the demand for power upon the generating-dynamo and engine is reduced. The application of power to each car avoids the necessity of an extremely heavy locomotive, and allows of a great diminution of the weight and strength of bridges and viaducts.

A large number of electric railways have been projected in this country, and some tried with a moderate degree of success, as at Toronto, New Orleans, Baltimore, and other places. The ex-

periment which has of late attracted the most attention has been the substitution of electricity for steam on the New York elevated railways. That this experiment has not succeeded as well as could be wished is not due to any inapplicability of electricity to the purposes of locomotion. All that has been attempted in New York has been successfully carried out in Germany, and a more careful copying of the details and methods of Messrs. Siemens & Halske would have produced success. The enormous traffic on these roads taxes to the utmost the carrying-capacity of the steam-plant, which is the result of half a century of study and modification of machinery of locomotives and cars. The substitution of electric motors for steam-locomotives will be a gradual process, and will progress just in proportion to the engineering skill brought to bear upon the problem. W. D. MARKS.

CARTWRIGHT LECTURES ON PHYSIOLOGY.

WHILE physiological science has made rapid advances in recent years, there are still many problems which it has as yet failed to solve, notwithstanding the fact that many patient and skilled investigators have devoted their entire time and energy to their solution. Among these problems, none is of greater interest and importance than the life-history of the blood, and to its elucidation the best minds in Europe and in this country have been directed. Prof. William Osler, M.D., of the University of Pennsylvania, was invited to deliver the fifth course of the Cartwright lectures of the Alumni association of the College of physicians and surgeons of New York, and selected as his subject, 'Certain problems in the physiology of the blood.' The course of these lectures began the evening of March 23, at the hall of the Young men's Christian association.

The first lecture dealt with the blood-plaque, which is also known as the elementary corpuscle of Zimmerman, the haematoblast of Hayem, the third corpuscle and blood-plate of Bizzozero. In blood withdrawn from the vessels, in addition to the red and white corpuscles, are seen grayish granular masses, being from ten to fifteen times the size of a red corpuscle. These are known as Schultze's granule masses. They are made up of small bodies, which are of uniform size, and, seen in face, have a disk shape, and in profile appear as rods. These bodies are the blood-plaques. Their diameter is from 1.5 micro-millimetres to 3.5 micro-millimetres. They are always found in mammalian blood, though their number is subject to considerable variation, in health averaging one to twenty red corpuscles. The estimates of their number, made with the haemacytometer, give about two hundred and fifty thousand of them to each cubic millimetre of adult blood. In the new-born this may be doubled, as also in consumption. In fact, in all wasting diseases their number is much increased, as not only in consumption, but also in cancer and in anaemia; and they appear sometimes to occupy nearly the whole field of the microscope. During acute fevers they are much diminished in number, and again increase during convalescence.

When the blood is withdrawn from the blood-vessels, these plaques have a tendency to conglutinate, forming the granule masses of Schultze; and so rapidly does this occur, that it would appear to be the condition in which they exist while within the vessels. This is, however, not the case, but is a property which they possess analogous to the nummulation of the red corpuscles. That this state of conglutination is not the natural one may be shown by examining the blood while circulating in a living animal, as in the omentum of a guinea-pig or rabbit, or in the subcutaneous tissues of a new-born rat, which is admirably adapted to the purpose. Or, if a drop of a solution of osmic acid (one per cent) or Pacim's fluid be placed upon the tip of the finger, and then the finger pricked, so that a drop of blood will flow directly into this solution, and then the whole transferred to a microscope-slide and examined, it will be found that the plaques are isolated, and the tendency to coherence has been overcome.

There are some investigators who hold to the opinion that these blood-plaques are disintegrated white corpuscles, but the objections to this explanation are numerous and incontrovertible. It may therefore be considered as established that the blood-plaque is a separate entity, and distinct from the mature red and white corpuscle.

The history of these corpuscles may be divided into three periods. In the first, prior to 1877–78, a number of investigators were at work upon it, among them Donné, Zimmerman, and Erb. In 1874 Osler pointed out that the granule masses of Schultze only formed after the blood was withdrawn from the blood-vessels. In the second period, 1877–78, Hayem demonstrated the existence of this third corpuscle, and called it haematoblast. In 1882 additional researches were made by Bizzozero, who described it as a blood-plate. In the third period, from 1882 to the present time, a number of investigators have been at work, and there have appeared some twenty different articles upon the subject. Kemp has been investigating the question at the Johns Hopkins university, and his paper will contain a full bibliography.

The second lecture in the course was delivered March 27, and treated of the degeneration and the regeneration of the corpuscles.

In our study of the blood, we find that there are factors constantly at work to maintain its histological uniformity, but as to these processes our knowledge is still very imperfect. In some conditions, as during fever, anaemia, and after hemorrhages, the number of the red corpuscles is very much diminished. In profound anaemia there will be found in the blood the normal red corpuscle, certain small corpuscles to which the name microcytes has been given, and larger ones, known as megalocytes. In addition to these, are very irregular forms known as poikilocytes. In atrophy of the stomach the condition of microcytosis, in which the microcytes abound, is very marked. The interesting question concerning these forms is, Are they young cells on their way to the formation of the red corpuscle, or are they degenerated red corpuscles on their way to disintegration? Hayem considers that first in order come the blood-plaques, and then the microcytes: Osler, on the other hand, believes them to be degenerated corpuscles, fragments of the old ones. In anaemia, where the irregular shape of the corpuscles is marked, or the condition of poikilocytosis, as it is termed, this may go on to such a degree as to lead to the separation of small particles; and this suggests a possible origin of the microcytes. They may also be formed from the red corpuscles by fission and budding, as may be seen in the red marrow of the bone.

The megalocyte may be studied in anaemia induced by hemorrhage. It has a diameter twice that of the red corpuscle, fourteen millimetres: it is not usually circular nor biconcave, but flattened and irregular. In these cases of induced anaemia by hemorrhage, the white corpuscles are increased in number, both relatively and absolutely; and, as we have already learned, the blood-plaques are increased. In severe anaemia or leukaemia we may find nucleated red blood corpuscles, which are normally formed during foetal life, in the new-born, and up to the age of four or five years. One of these may be seen in every three or four fields. These corpuscles in various stages of development may be studied in the red marrow of the bone, as the vertebrae and the ribs of the child and embryo. Here we find a small solid cell or nucleus; next, this with a layer of translucent protoplasm; next the protoplasm becomes colored, and we have a nucleated red corpuscle. The nucleus gradually disappears and disintegrates, giving us the non-nucleated red corpuscle. Rindfleisch thinks the nucleus emigrates from the corpuscle, but Osler thinks this is a post-mortem change when it occurs. Some authorities regard these extended nuclei as the blood-plaques. Bizzozero describes a process of fission in the red corpuscle by which it becomes two cells, and thus explains the formation of new corpuscles, those that undergo fission being direct descendants from the embryonic red corpuscles. Hayem regards the blood-plaques as becoming the red corpuscles. In cells which are to be seen in lymph-glands, in the spleen and the bone-marrow, are oftentimes to be found red corpuscles, which some regard as on their way to degeneration: others look upon them as being new cells. In this intracellular production of the red corpuscles, Osler is a believer.

The third and last lecture of Professor Osler, in the Cartwright course before the Alumni association of the College of physicians and surgeons, was delivered on March 30, and dealt with 'The relation of the corpuscles to the process of coagulation.'

The views of Buchanan, published soon after 1830, that the coagulation of the blood was dependent upon the white corpuscles, which acted like a ferment somewhat as rennet does in the coagulation of caseine, had for many years been forgotten and ignored. Schmidt of Dorpat, and his pupils, later elaborated these views of Buchanan. They considered that the white corpuscles furnish fibrinoplastine or paraglobuline, and a ferment, while fibrinogen exists normally in the plasma of the blood; that the white corpuscles, in furnishing these two elements, undergo disintegration and destruction.

Woolridge has, within the past few years, maintained that the white corpuscles play an important part in the formation of fibrine. He has been able to procure leucocytes, or colorless corpuscles, from the lymph-glands; and when these corpuscles, to which has been added an equal volume of a ten-per-cent solution of salt, are placed in peptone-plasma obtained from the blood of an animal into whose vessels peptone has been injected, coagulation at once takes place. The quantity of fibrine which is thus produced depends upon the number of leucocytes added. These corpuscles seem to form the fibrine, and the weight of the fibrine is the same as that of the leucocytes added. The albumen undergoes no change, while examination shows that the leucocytes have undergone disintegration.

The formation of fibrine in the blood may be studied in the moist chamber. The time at which the process commences varies from fifteen seconds to two minutes. Before coagulation commences, all the corpuscles can be easily distinguished; and Osler has never seen any appearance indicating

that the fibrine filaments were formed by a disintegration of the white corpuscles. On the other hand, these corpuscles seem to be stable elements. As a matter of fact, no observer has claimed ever to have seen the actual change of a corpuscle into fibrine.

The process of coagulation can also be studied in a fine capillary tube. The clot forms in the centre, and the serum outside. The white corpuscles seem to be squeezed out of the clot, or to migrate from it.

Landois, whose observations were made some ten years ago, thinks that the red corpuscles are connected with the formation of fibrine.

But the most interesting of all the problems is the relation of the blood-plaques to this process of coagulation. In blood drawn from the vessels we see fine filaments shooting out radially from the granule masses of Schultze, — those masses which we have already learned are collections of the blood-plaques. Ranvier, in 1873, regarded these as the centres of fibrine formation. The fibrine certainly does stand in a thick, dense network about these masses. In healthy blood, fibrine also appears entirely independent of the plaques. The filaments are fine, and appear much like margarine crystals. These filaments may be especially dense near the plaques; but any one can satisfy himself, by examining the blood in the moist chamber, that the fibrine forms independently of them as well. If we pass a ligature through the femoral vein of a dog, and allow it to remain for five minutes, particularly if we have separated the threads of the ligature, and then examine it, we shall find it coated with blood-plaques. If the blood of a dog is received into a cup, and this is whipped with a brush of threads for five minutes, we have the same aggregation of the plaques upon the threads: some white corpuscles will also be found, but the plaques are the striking feature. If these threads are dipped into a solution containing a coagulable substance, clotting will at once take place. The greater the number of blood-plaques, the denser and firmer will be the clot.

Still more instructive and interesting is the study of thrombosis, or clotting in the blood-vessels. If a dog is bled to death through a cut in the femoral artery, and the vessel excised and placed in osmic acid, and subsequently examined, we shall find on the cut edges and in the lumen of the vessel a finely granular material, and outside of this a darker mass composed of red corpuscles. The inner portion, the finely granular material, however, which is in contact with the elastic lamina, is composed of blood-plaques, and not white corpuscles. These plaques are the first elements or factors in the formation of a thrombus. Eberth, in Virchow's 'Archives,' has just shown that the first elements to settle and to lodge on lacerated vessels are blood-plaques. In all white thrombi these plaques seem to make up their bulk. If a needle is passed through a blood-vessel in the omentum of a living animal, the first elements which collect at the point of injury are the blood-plaques, and a distinct white thrombus is formed. These observations on the relation of the plaques to coagulation have been made by Bizzozero, Hayem, and Eberth.

In the circulating blood the plaques keep with the red corpuscles. If we examine a vessel of the omentum of the rabbit or guinea-pig, we shall see only a red streak, which occupies the central part of the vessel. In the space between this and the wall of the vessel, in the still layer as it is called, we may occasionally see a few colorless corpuscles. If the circulation now becomes slower, we shall see the plaques in the still layer with these colorless corpuscles. If atheromatous ulcers of the aorta are examined, it will be found that the material which has collected upon them is made up of blood-plaques: the same is true of the vegetations found upon the valves. While the distinct plaque form is apparent in the superficial parts of these structures, and the same is true of white thrombi, the deeper parts are also plaques, but in a granular state of disintegration.

Eberth has shown, that while, in the rapidly circulating blood, the corpuscles and plaques are together, yet, if acid is placed on the edge of a vessel or laceration, the plaques collect, and form a definite aggregation or white thrombus. We frequently find in autopsies atheromatous ulcers or calcareous plates which have no thrombi: in these cases, the circulation during life having been rapid, the plaques remained central; but, as the current becomes slower, these plaques become peripheral, and adhere to surfaces denuded of endothelium, and thrombi result.

LONDON LETTER.

IMPORTANT changes are in progress at Oxford which will give the university a real faculty of medicine. It has hitherto conducted medical examinations for graduates in arts who have obtained their professional education elsewhere, generally at one of the great London hospitals. But in future Oxford men will be able to enter the university as medical students, as has long been the case at Cambridge. It will still be necessary for them, however, to graduate in arts, which will practically mean in the school of natural science, before they can proceed to a medical degree; and,

as the exemption of natural science men from the classical examination known as 'moderations' will shortly come into operation, there will be no difficulty in this respect. A skilled anatomical teacher, Dr. Arthur Thomson, has been imported from Edinburgh; and the names of Profs. Bayley Balfour, Burdon Sanderson, and H. N. Moseley, are a sufficient guaranty that the preliminary training in botany, physiology, and zoölogy will be thoroughly efficient.

In the person of Mr. C. W. Peach, another member of the good old school of British naturalists has passed away. He began life as a coastguardsman in the preventive service, and soon acquired an intimate knowledge of the marine fauna of the south of England. When not engaged in detecting smugglers, he devoted his energies to zoölogical and geological studies, and was rewarded by the discovery of many new species among the lower invertebrates, and also, a point of much more importance, of traces of fossil fishes in the Devonian rocks of Devonshire. Later on he received an appointment in Scotland, and his discovery of fossils in the altered rocks of the highlands proved to be one of the utmost value in the skilled hands of Sir Roderick Murchison. Mr. Peach's great powers of observation and rich store of knowledge were always at the service of professional scientific men. Lyell and Murchison, Forbes and Carpenter, Gwyn Jeffreys and Wyville Thomson, and many others, who are happily still with us, knew and valued him highly. His son, Mr. B. N. Peach, is a distinguished member of the geological survey of Scotland.

The American friends of the late Dr. Thomas Davidson may like to know that a fund is being raised by the mayor of Brighton for the purpose of placing some memorial of him in the museum of that town. It was the object of his constant care during the many years that he resided at Brighton, and it is felt that his services in the cause of science deserve some permanent commemoration. His library and large collection of brachiopods are now in the Natural history museum at South Kensington.

Some important statements which have been recently made in the house of commons indicate that the government is going to form a department of the board of trade which shall do for England what the fishery board of Scotland and the Irish commissioners of fisheries do for Ireland. It is hoped that this may be the first step towards the establishment of a definite board of British fisheries, analogous to the department of botany at Kew, the geological survey office, and other similar institutions. At the present time the English fisheries are not under the supervision of any professional naturalist whatever, and their interests suffer in consequence.

Although February last was the coldest on record in England, the first ten days of March were colder. Only once in that period, viz., at the Scilly Islands, off the south-west corner of England, was 50° F. recorded at any station in the British Isles. Nothing above 43° was recorded in London in that period, and from Feb. 19 to March 11 there was a frost every night in London. Though March, 1883, was the coldest March but two of this century, 52° was recorded on March 5 of that year. On March 19 the frost suddenly broke up, terminating the twenty-four days' continuous skating which had been enjoyed in a northern suburb of London; and since then the weather has been very mild.

The results of the experiments in the Pasteur laboratory are being watched with the keenest interest. One of the Russian moujiks, who had been bitten by a mad wolf, has died, but the others show no sign of disease. The children and other patients sent from Bradford (Yorkshire) have returned thither, and are loud in praise of the treatment they have received. It is rumored, as a result of the question in the house of commons mentioned in the last London letter, that the government intends to appoint a royal commission to investigate the question. The names of Sir James Paget, Sir W. Jenner, Dr. Lauder Brunton, Prof. Burdon Sanderson, and Sir H. Roscoe, are mentioned in this connection.

A very crowded audience assembled a few nights ago to hear a paper upon domestic electric lighting, by Mr. W. H. Preece, head of the electrical department of the general post-office. He expressed the opinion, that, although England was beaten by so many countries in the adoption of arc-lighting, she probably led the way in the domestic use of incandescent lamps. These, however, were all private and separate installations, many instances of which were given. The electric lighting bill of Lord Rayleigh, introduced into the house of lords on March 19, would, if it became law, remove the disabilities imposed by the act of 1882. Although the nomenclature and efficiency of glow-lamps was in a very unsatisfactory state, enormous improvements had been made in the dynamo since the expiration of the patent monopoly. It was now the most perfect existing converter of energy, and was one-third the price, and its output was trebled: hence it was nine times better than it was a few years ago, during the existence of the patent. A lively discussion followed the reading of the paper.

Mr. W. H. Christie, the astronomer royal, recently lectured at the Royal institution on uni-

versal time, in the course of which he paid a high compliment to the railways of the United States and Canada for having reduced the number of local times from seventy-five to five, by adopting the five standard meridians. The scheme of hourly meridians, however, could only be considered a provisional arrangement, which would ultimately lead to the adoption of universal time, for which he thought the name 'world time' would be the best. The 'world' day would commence at Greenwich, midnight, and count from 0 h. to 24 h. Among the authorities cited by Mr. Christie in support of the twenty-four hours system, was that of the president of the Western union telegraph company (U.S.A.), who considered, that, in addition to diminishing risk of errors, it would save the cost of a hundred and fifty million letters annually. W.

London, March 27.

NOTES AND NEWS.

THE fourteenth annual meeting of the American public health association will be held at Toronto, Ont., Oct. 5-8, 1886. The executive committee have selected the following topics for consideration at said meeting: 1. The disposal of the refuse matters of cities and towns; 2. The condition of stored water-supplies, and their relation to the public health; 3. The best methods and the apparatus necessary for the teaching of hygiene in the public schools, as well as the means for securing uniformity in such instruction; 4. Recent sanitary experiences in connection with the exclusion and suppression of epidemic disease; 5. The sanitary conditions and necessities of school-houses and school-life; 6. The preventable causes of disease, injury, and death in American manufactories and workshops, and the best means and appliances for preventing and avoiding them; 7. Plans for dwelling-houses. The local committee of arrangements at Toronto, Ont., have already actively begun the work essential to a large and successful meeting. In addition to the usual work incident to such an undertaking, they will extend invitations to foreign sanitarians, and secure such transportation facilities as will probably insure a good representation from abroad. Communications regarding matters of transportation or of a local character should be addressed to Peter H. Bryce, M.D., chairman local committee of arrangements, Toronto, Ont. Mr. Henry Lomb of Rochester, N.Y., who is already well-known through the prizes which he gave last year for the best essays on certain sanitary subjects, offers for the present year the sum of seventeen hundred and fifty dollars, to be awarded as prizes on the following subjects: 1. The sanitary conditions and necessities of school-houses and school-life, one prize, $500; 2. The preventable causes of disease, injury, and death in American manufactories and workshops, and the best means and appliances for preventing and avoiding them, one prize, $500; 3. Plans for dwelling-houses, — (a) A plan for a dwelling-house not to exceed in cost, exclusive of cellar, eight hundred dollars (prizes: first, $200; second, $100; third, $50; fourth, $25); (b) A plan for a dwelling-house not to exceed in cost, including the cellar, sixteen hundred dollars (prizes: first, $200; second, $100; third, $50; fourth, $25). Accommodations to be provided for families consisting of five persons. All essays and plans for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before Aug. 15, 1886.

— The officers of Section D (mechanical science and engineering) of the American association for the advancement of science have issued a circular stating that the steadily increasing interest and importance of the meetings of Section D justify the expectation of a large attendance of engineers at the Buffalo meeting. The meetings of the American association offer to students of mechanical science and to engineers opportunities which cannot be elsewhere obtained, of conveniently meeting at one time a large number of gentlemen eminent in branches of science to which engineering is closely related, especially mathematics, physics, chemistry, geology, and economic science. The scope of this section is broad enough to include all branches of engineering. It occupies a field peculiar to itself, which by no means encroaches upon that of the various engineering societies, but rather adjoins and supplements it. These societies deal chiefly with accomplished practical results, while Section D affords an opportunity for the presentation and discussion of papers upon the application of scientific methods to every department of engineering. The object of the section, in accordance with the name of the association, is the 'advancement of science.' The following may be named as among the general classes of subjects which this section may properly consider within its scope: mechanical science in the abstract; mechanical research; problems in engineering of national importance, and such as are connected with more than one branch of engineering; the education of engineers; the relation of the government to engineers in civil life; the endowment and organization of mechanical research. The officers extend a cordial invitation to all to attend the meetings of the section, and to contribute such papers or discus-

sions as will aid in furthering its objects. It is requested that all who intend to contribute papers will notify the secretary (William Kent, 92 Reade Street, New York) as soon as possible. The committee on the best method of teaching mechanical engineering, — Prof. J. Burkitt Webb, Prof. George J. Alden, Dr. Calvin M. Woodward, and Prof. Arthur Beardsley, — and the committee on the use and value of accurate standards, screws, surfaces, and gauges, — Prof. William A. Rogers, Mr. Oberlin Smith, and Prof. J. Burkitt Webb, — are expected to present reports at the Buffalo meeting.

— The fish commission steamer Albatross arrived at Nassau, New Providence, March 19, after a most successful trip. The ship was chiefly engaged in making soundings. Two naturalists were landed at Watling's Island, San Salvador, where much valuable scientific material was gathered during a stay of two weeks. But little dredging has been done, so that few accessions of marine life have been made. At Rum Cay, Conception Island, Cat Island, and Great Exuma Island, the naturalists of the expedition obtained many valuable specimens of fish, lizards, bird's-nests, eggs, cave relics, pottery, and about five hundred bird-skins. These islands are very small, and thinly populated. Vegetation is scarce, and the islands themselves are formed almost entirely of rock. Cocoanut-trees and bananas are abundant, but oranges and apples rather scarce. The Albatross is now at Key West, and will spend some time dredging in the Gulf of Mexico and vicinity.

— General Hazen said recently, in his testimony before a congressional committee, that foreign signal stations were a necessity, and the establishment of a station in the West Indies had fully demonstrated this fact. It is quite probable that congress will authorize the establishment of stations at important foreign points.

— The commissioners of the District of Columbia have refused the gift of Judge Pacificus Ord, of a tract of land along Rock Creek for a zoölogical garden. The grant was made on the express condition that the property should be used for a free zoölogical garden and free public baths, to be kept by officers created by congress for that purpose. The commissioners think there is no present need of a zoölogical garden or bath-house, nor have they the means to establish them.

— The U. S. fish commission is busily engaged in stocking the Great Lakes with white-fish. Cars Nos. 2 and 3 are now at Northville, Mich. About April 15 the shad distribution will begin. The eggs are hatched at the Fort Washington station, and shipped to the central station of the commission at Washington, the distribution being made from there. The distribution of carp has ceased for this season, as it has been found impracticable to ship these fish after the first of March; the young carp developing fungus, and becoming emaciated.

— No less than forty-four wrecks appear on the April number of the 'Pilot chart' issued by the hydrographic office. Some were seen in January, but the greater number are reported from observations late in February and through March. Three recent cases of disastrous collision with sunken wrecks are quoted. It is announced that the vessels of the National line, including all the cattle-steamers, have made arrangements for the regular use of oil in rough weather.

— The bark Flora (Spanish) reports that on March 21, Cape Hatteras, bearing W.S.W., distant thirty-five miles, three very large seas came up from astern [vessel probably heading north], and in passing caused the vessel to roll deeply. At the time the sea was very smooth, and became so again immediately after the passage of the heavy swells. There was a light breeze from S.S.W. The captain says he never saw or heard of such an occurrence before. On p. 266, vol. ii., of the 'Voyage of the Challenger,' Sir Wyville Thomson says, "It must be a wonderful phenomenon, an enormously heavy swell arising in a perfectly calm sea, without any apparent cause, and breaking against the leeward coast of the island (Ascension) with almost irresistible fury."

— A bottle was found floating near the beach at Colon, on the 1st of February. It had the appearance of having been some time in salt water, and was found to contain two papers on which was written as follows: "Lat. 12° 47′ N., Long. 24° 47′ W., noon, Saturday, 20th December, 1884; ship Patriarch 69 days out from New Castle (N.S.W.), and bound for London; all well."

— The New York *Evening post* states that "the treasury commission for investigating the coast survey have addressed a communication to the secretary of the treasury in which they say, 'In the light of the demonstrated inaccuracy of some of the evidence upon which the committee relied, and to the extent hereinbefore indicated, it is but just to admit that the criticism of Mr. C. S. Peirce in the committee's report was unwarranted by the facts.' It is understood to be admitted that Mr. Peirce's expenditures were overstated, and his work undervalued. The only criticism the committee continue to maintain is, that he

practically conducted his operations as he saw fit. His work has been done under detailed instructions issued by the superintendent of the survey, and these instructions have been based upon projects which Mr. Peirce was required to submit each season. We will only add that this finding is what every one acquainted with Mr. Peirce must have expected as the result of a calm and unprejudiced examination."

— Telegrams received from Professor Pickering announce the discovery of three new asteroids by Dr. Palisa of Vienna. The first was discovered on March 31, and was of the thirteenth magnitude; the other two, on April 2 and 3, of the thirteenth and twelfth magnitudes. These three will receive the numbers 254, 255, and 256 respectively, and will raise the whole number discovered by Dr. Palisa to fifty-three.

— The programme for the second half of the course of lectures under the auspices of the Anthropological and biological societies of Washington is as follows: Saturday, April 10, Dr. Washington Matthews, U.S.A., The gods of the Navajos; Friday, April 16, Dr. D. B. Simmons, Social status of the women of Japan; Saturday, April 24, Prof. W. K. Brooks, Life; Saturday, May 1, Mr. Lester F. Ward, Heredity and opportunity; Saturday, May 8, Dr. J. S. Billings, U.S.A., Animal heat.

— The series of summer schools of the Monteagle (Tenn.) assembly is announced to open on June 30, and continue to Aug. 25. The scientific instruction in chemistry, geology, and botany, will be under the charge of Prof. J. I. D. Hinds.

— We cut the following from the Atlantic 'Pilot chart' for April: "Mr. J. H. Barker, an oil-merchant of New York, informs the branch hydrographic office that he has the contract with, and since Jan. 1 of this year has furnished, the National line of steamships with oil to be used to lessen the dangerous effects of heavy seas. Ten vessels, including all the cattle-steamers, have been provided with the necessary appliances to use oil when occasion requires. The company's requisition called for fish-oil, but the recent experiments proved it thickened too rapidly when in contact with water at the general low winter temperatures. To obviate this tendency, Mr. Barker has mixed a mineral oil having a low, cold test, with fish-oil which has a comparatively high test: the result is an oil which coagulates at a much lower temperature than ordinary fish-oil, but which it is claimed will be as efficacious. The mineral oil has stood the test as a lubricant for railroads in cold weather, and it is claimed will be very useful for sea purposes when mixed with a proper proportion of fish-oil, during the mild and warm months fish alone is to be supplied. The method adopted of using oil is by means of punctured canvas bags filled with oakum."

— From numerous experiments on flies, beetles, hymenoptera, neuroptera, and lepidoptera, M. Plateau concludes that insects with compound eyes, with or without simple eyes, pay no heed to differences of form in the light openings of a half-darkened room, but fly with equal readiness to the apparently easy and apparently difficult way of escape; that they are attracted to the more intensely lightened opening or to one with apparently greater surface; and that, in short, they cannot by vision distinguish form, or only to a very slight extent.

— Chief engineer Melville of the ill-fated Jeannette has recently stated that he is still endeavoring to organize another polar expedition, and, although his schemes have met with little success, he will yet continue to work upon them.

— The question of the movements of the ulna and radius of the human arm during the act of pronation and supination has of late provoked considerable discussion among students of anatomy. The view most commonly held and taught, that the elbow-joint is a perfect hinge, and that the ulna remains fixed during pronation and supination, has been disputed by some recent investigators. At the last meeting of the Biological society of Washington, Dr. Frank Baker read a paper upon this subject, in which he concludes that the ulna is capable of considerable lateral movement, and that in pronation and supination both the ulna and radius rotate. Dr. Harrison Allen of Philadelphia has also been studying this question with the aid of instantaneous photographic apparatus, and is said to have reached similar conclusions.

— Harrison & Sons, London, announce 'Physico-chemical constants, melting and boiling point tables,' by Thomas Carnelley, professor of chemistry in University college, Dundee. These tables will contain about fifty thousand melting and boiling point data. The object of the tables is as follows: 1. To present as complete a list as possible of all known melting and boiling point data, and at the same time to indicate which of them is probably the most exact, when there are several determinations referring to the same substance; 2. To state as fully as possible the constitution of each substance to which the data refer; 3. To adopt such a system of ar-

rangement as will facilitate as far as possible the ready finding of the data relating to any given substance ; 4. To give the authority and reference to the original memoir in each case (the tables thus form a catalogue of the literature referring to most chemical substances) ; 5. To give, in addition, the reference, if any, to either 'Watt's dictionary of chemistry,' or to the journal of the Chemical society, for the convenience of those who are unable to refer to the original papers (this is a feature of the work which will doubtless be found particularly useful, more especially to British and American investigators). The tables will be issued in two volumes, of which the first is now ready.

— Prof. Mansfield Merriman of Lehigh university, Pennsylvania, has published a "Key to his text-book on the mechanics of materials." This key contains the answers to the problems in the text-book, and is published in response to inquiries from those who have used the book. The opportunity has also been taken to give the method of solution of a few of the difficult problems.

— The first part of the new zoölogical journal announced by us some time since, to be edited by Dr. J. W. Spengel of Bremen under the title of *Zoologische jahrbücher*, will be soon published, and will contain the following papers, besides shorter notices: Hartlaub, 'Contributions to the knowledge of the species of Manatus ;' Reichenow, 'Monograph of the genus Ploceus, Cuv.;' Bergh, 'The Marseniadae ;' Nehring, 'Contributions to the knowledge of the species of Galictis ;' Frenzel, 'On glycerine preparations.' The price of the part is nine marks. Four parts make a volume. Beside the regular parts, supplementary ones will be issued from time to time for the publication of separate papers too long to appear in the journal itself. The regular subscribers may or may not take the supplements also, as they prefer. The first of the supplements is to appear shortly, and will contain Dr. K. Jordan's memoir on the butterfly fauna of north-west Germany.

— Dr. Patrick of St. Louis has in preparation a work on the mounds of southern Illinois, based upon a large collection of crania and other objects from that region. His report will be issued by the U.S. bureau of ethnology.

— Prof. E. D. Cope of Philadelphia is about to publish a monograph on the recent batrachians and reptiles of North America, as a bulletin of the national museum. It will contain descriptions of all the species so far known, many of which will be figured, together with an extensive discussion of the osteology of the several groups, and a sketch of the soft anatomy of the leading types.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

International copyright.

MR. APPLETON MORGAN, in his letter upon international copyright in *Science* for March 5, says, "While always an enthusiastic advocate of an international copyright as a matter of abstract justice to British authors, I have never been able to satisfy myself of the constitutional right of congress to enact a separate bill for the purpose of effecting one." I do not intend to attempt, in this letter, to convince Mr. Morgan that the enactment of such a bill would be constitutional, but I think it may not be without interest to the readers of *Science* to point out that the passage in the constitution which grants congress the power to "secure to authors and inventors the exclusive right to their respective writings and discoveries" has been expounded to mean, of necessity, *all* authors and inventors, without regard to nationality.

Edward L. Andrews, Esq., as the representative of the Copyright association, argued before the senate committee on the library, in 1872, that, as American authors were not specified in this clause, the word 'authors' must be taken to mean all authors, wherever resident, and therefore the constitution "in this respect is mandatory in its character." But Mr. Andrews was not the first person to argue this construction of the constitution. Thirty-five years earlier this construction had so distinguished an advocate as Mr. Henry Clay. During the copyright agitation of 1836–37 in England, certain British authors sent to the United States an 'address' containing a petition to congress to grant to them "the exclusive benefit of their writings within the United States." This petition, which bears the signatures of fifty-six authors of England and Ireland, — a remarkable list of names, including Carlyle, Disraeli (father and son), Bulwer, the poets Southey, Thomas Moore, Rogers, Campbell, Chalmers and Cunningham, Harriet Martineau and Mary Somerville, besides others equally famous, — was presented to the senate by Mr. Clay on Thursday, Feb. 2, 1837. After calling attention to the distinguished names appended to the document, and explaining that it represented that the works of British authors were published in the United States without any compensation being made to them for their copyrights, and that they were frequently altered and mutilated so as to affect injuriously their reputations, because of which grievances they petitioned the passage of a protective law, he commended the address to the attentive and friendly consideration of the senate, and closed with these words: "Indeed, I do not see any ground of just objection, either in the constitution or in sound policy, to the passage of a law tendering to all foreign nations reciprocal security for literary property." This petition was referred to a select committee, which reported Feb. 16, through Mr. Clay, and asked leave to introduce a bill granting copyright to the authors of Great Britain and France, which was the first international-copyright bill presented to congress. The last paragraph of this report contains Mr. Clay's argument, referred to above, and reads as follows: "With respect to the constitutional power to pass the proposed bill, the committee entertain no doubt, and congress, as be-

fore stated, has acted on it. The constitution authorizes congress 'to promote the progress of science and useful arts by securing, for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries.' There is no limitation of the power to natives or residents of this country. Such a limitation would have been hostile to the object of the power granted. That object was to *promote* the progress of science and useful arts. They belong to no particular country, but to mankind generally. And it cannot be doubted that the stimulus which it was intended to give to mind and genius — in other words, the promotion of the progress of science and the arts — will be increased by the motives which the bill offers to the inhabitants of Great Britain and France."

I believe that the view expressed by Mr. Morgan in the last paragraph of his communication is correct, and that a "Bill to amend the Revised statutes relating to copyrights" — amending section forty-nine hundred and fifty-two by striking out the words 'citizen of the United States, or resident therein,' and substituting the word 'person;' amending section forty-nine hundred and fifty four by striking out the words 'and a citizen of the United States, or resident therein;' amending section forty-nine hundred and sixty-seven by striking out the parenthetical clause '(if such author or proprietor is a citizen of the United States, or resident therein);' and repealing section forty-nine hundred and seventy-one — would secure to foreign authors protection over their works equal to that now granted to citizens or residents. It is really in this way that the bill introduced into the senate by Mr. Hawley grants protection to the works of foreign authors; the first section being in reality a limiting provision, stipulating that the protection is only granted to authors of such countries as confer equal rights of protection to citizens of the United States, in other words a reciprocity clause. By mistake, the Hawley bill neglects to provide for the amendment of section forty-nine hundred and fifty-two, though careful provision is made for the amendments necessary in the other sections.

THORVALD SOLBERG.

Washington, D.C., March 30.

The distinction between anatomy and comparative anatomy.

It was not so many years ago that even those holding the highest positions in the profession of medicine regarded human anatomy as the only anatomy entitled to the name, and that comparative anatomy meant something else altogether. Its teachings were not appreciated by the vast majority of those who studied the anatomy of man, and the great surgeons of those days were rather inclined to look askant at one who indulged in researches into the structure of the 'lower animals.' But in these days such matters wear a very different aspect, for anatomy means morphology, — the knowledge of the structure of organic forms, — both living and extinct, and it is rarely indeed that we hear of any one attempting to draw hard and fast lines between the anatomy of man, and either any of his own class or other representatives of the Vertebrata.

Thanks to the progress biology has made during the last quarter of a century, all literature that has any thing to do with such subjects, actually teems with the teachings of morphology. Such being the case, one is rather disposed to regard with some measure of surprise the classification that so excellent a work as the *Index medicus* adopts for its record of such subjects. In its last issue, for instance (February, 1886, p. 54), and I believe it has always adhered to the same plan, it makes one section for anatomy, histology, and embryology, and a subsection for comparative anatomy and embryology. Now, in the section-in-chief, we find entered the recent admirable paper by Dr. E. C. Spitzka, on 'The comparative anatomy of the pyramid tract,' the contribution evidently being considered as an 'anatomical one;' while we find awarded to the subsection Retterer's article entitled "Sur le développement des tonsilles chez les mammifères," to say nothing of all the anatomical articles from the last number of the *Journal of anatomy*, of London.

Now, as fully the larger share of Spitzka's memoir is devoted to the study of the pyramid tract in other animals than man, it would seem, even according to the plan adopted by the *Index medicus*, that that essay has not fallen into its proper section. The same stricture applies, for a similar reason, to Retterer's paper. Surely it would seem better to have one section devoted to morphology, to include all contributions that refer to the structure of organic forms, and, if necessary, two subsections, — one devoted to histology, and the other to embryology.

R. W. SHUFELDT.

Fort Wingate, N. Mex., March 30.

Penetrating-power of arrows.

You doubtless have read of the wonderful feats of archery said to have been performed by savage archers. Cabeça de Vaca, for instance, tells us that the good armor of the Spaniards was no protection against these missiles. Some of the men swore that they had seen two red oaks, each the thickness of the lower part of the leg, pierced through from side to side by arrows. I myself saw an arrow that had entered the butt of an elm to the depth of a span. The same author states that the corpses of the Spaniards were found to have been traversed from side to side by arrows. An instance is given, where an arrow shot by an Indian pierced through the saddle and housings, and penetrated one-third its length into the body of a Spaniard's horse. These quotations from Jones's 'Southern Indians' might be increased to any number, covering a period from the Homeric age to our day, all showing the popular belief concerning the power of the arrow.

I desire very much to induce our archery clubs to institute a series of careful experiments upon the following points: —

1. How far can an arrow be shot in a calm? How far with or against a moderate calm?

2. What is the greatest distance at which an arrow can be shot with any degree of accuracy? Experiments should be made both as to the vertical and horizontal.

3. What is the momentum of an arrow leaving a bow? (Tested by shooting against a disk attached to a graduated scale.)

4. What is the penetrating-power of an arrow into animals? This may be tried with horses, cattle, or dogs, which have just died, or with those in an *abattoir* just about to be slaughtered.

5. The register of the bow as to length, etc., and

a description of the arrow used, should be carefully preserved.

As soon as possible, I shall publish an account of the bows and arrows in the national museum, and shall be more than pleased to collate and preserve the results of careful experiments as a basis of comparison with the archery of savages. It is generally conceded that the archery clubs, with their much better artillery, achieve higher averages in shooting than could be attained by the aboriginal bowmen.

O. T. MASON,
Curator of Dept. of ethnology.

Smithsonian institution,
March 31.

Underground rivers.

In an article in *Nature* (Jan. 14. p. 246) entitled 'Curious phenomena in Cephalonia,' a former pupil of Ledger writes, "The sea runs into the land in a strong stream, turning a water-wheel on the way, and disappears in the earth about a hundred yards from the entrance. . . . I imagine that this water must be converted into steam, which comes out either at Naples or at Stromboli." Prof. Henry S. Williams of this university called my attention to this quotation, and to its indirect connection with what follows. The writer, while passing through Yucatan, Mexico, in 1870, saw a large stream running with torrential speed within a natural tunnel not far from the seashore, and probably over one hundred feet below the surface of the ocean. These underground rivers, which are said to be numerous in the neighborhood of the city of Merida, are called *zanates* (Tbah-n'ah-tess) by the inhabitants of Yucatan. I had time to visit only one of these remarkable subterranean rivers. Its shaft-like entrance was adorned by a picturesque old Spanish well-curb of stone, furnished with standards of fancifully forged iron-work. Nothing on the surface indicated the existence of the vast cavern under the monotonous and flat lowlands of the peninsula of Yucatan; and, though not a breath of air stirred, the deafening roar of the torrent under our feet could not be perceived until we were fully inside of the cave. A rapid descent brought us to the level of the pumps used for irrigating a very extensive *ixtle* plantation; and from here we could see, by the light of our torches, the yellow foam of the waters upon the undefined background of the chasm below. Descending still farther, the full stream could be seen through a wide fissure in the limestone of the cave. It had the rounded appearance of a stream flowing horizontally under great pressure, ten or twelve feet in diameter, and looking like a gigantic black icicle lying on its side. This large volume of water plunged with great swiftness into an unexplored and dark chamber with terrific roar, and producing noises which resembled the hollow echoes of heavy explosions heard now and then above the perpetual rumbling of the rushing water. A visit to this cave cannot fail to produce a very deep impression, and not unlike the feeling which renders so imposing the unpleasant experience of an earthquake.

The manager of the plantation informed me that the mouth or entrance of this *zanate* was only twenty-eight feet above the Gulf of Mexico; and since my barometer indicated a descent of a hundred and forty feet, if the information was correct, this stream was delivering, within forty miles from the seashore, a volume of fresh water about a hundred and twelve feet below the level of the sea. The temperature of the water was 52° F. and is said to remain constant throughout the year. Only a small portion of the stream was visible; and the direction of the current was N. 60° W. I could obtain very little additional information in reference to the other *zanates*, of which the natives speak with almost religious reverence as "great miracles which have always been as they are now."

Since the velocity of the water, as well as the form of its cross-section, can leave no doubt that the delivery takes place under a considerable head, it would be quite important to ascertain the location of its source, and learn why this cave does not fill up to within twenty-eight feet from the surface, if the stream communicates with the sea. This latter circumstance seems to prove that the elevation given by the manager of the plantation may be incorrect; but, besides the fact that the belief in the great depth of these *zanates* below the ocean is current among the cultivated people of Merida, the manager of the plantation insisted on the correctness of his figures, which were obtained by the instrumental surveys connected with the irrigation of his large estate, the waste water from which runs into the sea. It would seem desirable. therefore, to ascertain through the columns of *Science* if any one else has visited these *zanates*, and has satisfactory data bearing upon this question.

A study of the soundings made by the U. S. coast and geodetic survey upon the Bay of North America; the erosions showed by the stereographic model of the Caribbean Sea, made by Capt. J. R. Bartlett, U. S. N.; the gravimetric work conducted by Professor Peirce of the coast survey; and the hydraulic problems connected with the delta of the Mississippi River,— seem to involve problems related to the Gulf Stream which make desirable a better knowledge of these truly remarkable subterranean rivers.

E. A. FUERTES.

Ithaca, N.Y., March 30.

Note on the nocturnal cooling of bodies.

An interesting application to this subject may be made, by way of supplement, of the principles and expressions contained in my letter on the temperature of the moon (*Science*, vi. No. 150). According to these, the rate with which a body radiates heat is to that with which it receives and absorbs heat from a complete enclosure as μ^{θ} is to $\mu^{\theta'}$, in which $\mu=1.0077$, and θ and θ' are the temperatures of the body and of the enclosure respectively on the centigrade scale. In this case we necessarily have for the static temperature of the body, that of the enclosure remaining constant, $\theta=\theta'$; but, in the case of an incomplete enclosure, the body, at the same temperature, radiates more heat than it receives and absorbs from the enclosure, and consequently its static temperature is less than that of the enclosure, since it cools down until the rate with which it radiates heat is equal to the rate with which it absorbs heat received from the enclosure.

In the case of a thermometer exposed near the surface of an earth without an atmosphere, the earth's surface would form the half of a complete enclosure, since it would subtend a solid angle equal to that of a hemisphere. In this case the thermometer would receive no heat from the enclosure by re-

flection, but only the radiated heat; and the rate with which the bulb, if spherical, would radiate heat, would be to that with which it would receive and absorb heat as μ^{θ} to $\frac{1}{2} r' \mu^{\theta'}$, in which r' is the relative radiating power of the earth's surface. Hence for the static temperature of the thermometer, that of the earth's surface being supposed to be stationary, we should have

$$\mu^{\theta} = \tfrac{1}{2} r' \mu^{\theta'}, \text{ or } \theta - \theta' = 300 \log \tfrac{1}{2} r'.$$

In case of a maximum radiating power of the earth's surface, in which case $r' = 1$, we have

$$\theta' - \theta = - 300 \log \tfrac{1}{2} = 300 \times 0.301 = 90° \text{ C.}$$

for the difference between the temperature of the earth's surface and that of the exposed thermometer, the latter being the less. It is seen that the difference is the same, whatever the temperature of the earth's surface. According to this result, if the temperature of the earth's surface were maintained at 0° C., that of the thermometer would be −90° C., if the law of Dulong and Petit can be extended to so low a temperature.

If the earth's surface were polished silver, and of the ordinary temperature, the temperature of the thermometer would be nearly that of absolute zero. If we suppose that the earth's atmosphere, when clear, radiates and reflects back to the body four-fifths as much heat as the body radiates into it, then the enclosure, comprising the earth's surface on the one side, and the atmosphere on the other, lacks one-tenth of completeness, and we then have from the preceding expression,

$$\theta' - \theta = - 300 \log 0.9 = 300 \times 0.046 = 13.8° \text{ C.}$$

for the difference between the temperature of the earth's surface and that of the thermometer, in case the thermometer received no heat by convection and conduction from the surrounding warmer air. In the case of Melloni's cups, the former of these is prevented, and hence the thermometer in these stands at a lower temperature than one does suspended in the open air, where the colder air immediately in contact with the thermometer-bulb falls down, and warmer air takes its place.

Supposing the atmosphere and the earth's surface to furnish nine-tenths of a complete enclosure to a body near the surface, then, at an altitude which leaves one-half of the atmosphere below it, they would furnish something more than 0.7 of a complete enclosure; for the amount of heat escaping into space is not quite proportional to the mass passed through, especially in the case of dark heat. We should have, in this case,

$$\theta' - \theta < - 300 \log 0.7, \text{ or } 46.5° \text{ C.,}$$

in case of no convection and conduction; but these, of course, would diminish the difference very much. This result, in comparison with the preceding one, explains the low temperatures of bodies at night, when exposed in the air on high mountains a little above the earth's surface, so as to receive no heat from contact with the surface.

The greater the altitude, the more nearly would the difference approximate to 90° C., and would sensibly reach it at a point leaving no sensible portion of atmosphere above it, and even surpass it if the point were so high as to sensibly diminish the subtending solid angle.

The whole of the earth's surface, of course, cools considerably during a clear night; but this only continues until a temperature gradient is formed by which heat is conducted from the lower strata to the surface as fast as it is radiated into the atmosphere. This state, however, can be only approximately reached, and, if the night were continued, the cooling would still go on; but the rate of cooling becomes very small in the latter part of an ordinary night, and much less in that of a polar night. Bodies exposed in the open air, of course, receive no sensible amount of heat by conduction of heat through the air up to the bodies, and so their temperatures fall much lower than that of the earth's surface, and the differences are given by the preceding conditions.

WM. FERREL.

Maori poetry.

An example of Maori poetry may be interesting to some of your readers. The first is a modern Maori love-song composed by a young native and sent to his sweetheart. I am indebted to Mr. C. O. Davis of Auckland, New Zealand, for the translations.

At eventide I lay me down to rest,
As winds from the great ocean pierce my frame.
Come, ye soft northern airs, hasten your speed,
With messengers of love to me. O maiden!
Send me thy epistle to cheer this heart
Of mine, — to dry the tears which freely flow
For thee, O Rosa, absent from thee so long.
When darkness has set in, I rest alone,
The while I fancy thou art present,
And all my thoughts are fettered by thy love.

A maiden's lament on account of the desertion of her lover.

Retire, O sun! and leave the night to me,
While tears, like water, from these eyes are flowing.
The sound of footsteps is no longer heard,
O Taratu! thou comest not again
By way of Waihipa's headlands; still
The sea-fowl show their breasts at Mitiwai,
But my lover lingers in the north,
Binding thyself to thy own landscapes there.
Ah! shall my days of weeping never cease?

C. F. HOLDER.

Pasadena, Los Angeles county, Cal., March 21.

Names of the Canadian Rocky Mountain peaks.

As to the naming of the Canadian Rocky Mountain peaks, Mr. Ingersoll may withdraw his correction made upon the authority of Dr. George M. Dawson. Here is an extract from Douglas's journal, under date of May 1, 1827, printed in companion to *Botanical magazine*, ii. 136, in 1836.

"This peak, the highest yet known in the northern continent of America, I felt a sincere pleasure in naming 'Mount Brown' in honor of Robert Brown, Esq., the illustrious botanist, a man no less distinguished by the amiable qualities of his mind than by his scientific attainments. A little to the southward is one of nearly the same height, rising to a sharper point: this I named 'Mount Hooker' in honor of my early patron the professor of botany in the University of Glasgow."

Dr. Hector, "who in 1857–59 was attached to Captain Palliser's expedition," may indeed have named 'Mount Balfour,' curiously sandwiched between the names of Hooker and Brown. Douglas could not well do that, the worthy Edinburgh professor so honored being at that time a lad of nineteen.

A. G.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 9, 1886.

REMARKABLE POWERS OF MEMORY IN THE HUMBLE-BEE.

PROF. EDWARD HOFFER gives in the last number of *Kosmos* a contribution to animal psychology, which will be of interest not only to the entomologist, but to all biologists. It furnishes evidence of some very strange powers of memory of localities, in this group of insects, whose brains, if we may use that term, one would hardly deem capable of such functions.

The author removed a nest containing numerous individuals of one of the common humble-bees (Bombus terrestris) from its original location, and carried it to his residence, about three miles distant. He further carefully watched the place for some time after having captured all those that had flown to the defence of their nest, and secured, it was believed, the entire colony. These he imprisoned for several hours in a wide-mouthed bottle, and safely re-united them in their new home. At his house he placed the nest, with its inhabitants, near a window, and, after they had become quieted, made a small entrance. Immediately they began to fly out, and in doing so must have observed their surroundings, for in a short time they one by one returned. The following night, however, there was a severe storm; and while the inhabitants of the forty other colonies near it, that had become accustomed to their surroundings, were not in the least troubled, these bees escaped, and hid themselves somewhere without during the storm. Upon searching for them early the next morning, the queen was found dead upon the ground, while fifty or sixty of the workers were seen flying about the house. From time to time one or another — probably those which had flown out of the entrance the day before — found the opening, and returned into their nest; while the remainder, after flying about for several hours, gradually disappeared, till not one was left. As it was supposed that they had, in all probability, returned to their previous nest, the place was visited in the afternoon, where, sure enough, at least fifty individuals were found. They had thus, it will be seen, distinctly remembered it, and, after they had sought in vain to find entrance to their new home, they had depended upon their wonderful sense of locality, and returned thither.

A similar instance was observed with another nest, which had been removed a distance of nearly five miles, and in which the same care had been exercised to capture all the individuals. In unskilfully handling the box containing the nest and bees, in its new location, about thirty of the workers escaped, and flew through the open window. After flying for a long time about the house, as though in search of their comrades, they likewise disappeared, and returned to their original nest and again established themselves, as was afterwards ascertained.

It was frequently observed, that, when nests had been removed but a short distance, the workers, during the first few days after their change, would fly swiftly in the direction of their old nest, when, discovering their mistake, they would change their course, and go to their new home. It seemed evident that these little creatures, through some mental process or other, thus discovered their changed circumstances.

In order to test further this remarkable sense of locality, the author marked a number of individuals with oil-colors, and carried them, enclosed in wooden cases, a distance of eight or nine miles, when he allowed them to escape. Very many of them, though not all, found their way back to their nests, and, as a rule, reached home sooner than the author did himself.

The author noticed that at his summer residence, where he had kept numerous hives of these bees, the following spring many individuals appeared, and seemed to be searching for their previous nests; but he was unable to determine whether they were individuals of the previous broods or not. Towards the close of July, 1884, he obtained three nests of Bombus mastrucatus, a large species, only found in the mountains, and especially the higher regions, and carried them to his residence in the city, where he placed them in a window of the second story. The house was enclosed by high buildings, with no garden attached, and yet they returned readily and directly from their excursions to their nests. They throve, and by the first of October had increased to considerable numbers. By the middle of October they wholly disappeared; but, in the early part of the following April, individuals of this species were observed flying about the window, and, as soon as they found an entrance, sought the remains of their old nests, and took up their abode. They remained for a while, when their nest was accidentally injured, and they

left. Nothing more was seen of them till after the author's return from his summer vacation, in the middle of September, when a single female of this species made its appearance. In their inability to obtain an entrance through the closed window, they had evidently built a new nest in the vicinity, and reared their broods.

These circumstances indicate that the intellectual powers of the humble-bee are not as slight as we have been accustomed to believe. Here in this case, from October to April, — a period of six months, — had these bees remained dormant in the ground, or hidden in some crevice, and, upon regaining their activity, had not only remembered the place where they were, but had sought and found, despite the many difficulties, their last year's nest. That these individuals were from the previous year's brood, there was no doubt, as throughout the province the species nowhere else occurs, peculiar as it is to elevated and mountainous regions.

LIGHTHOUSE ILLUMINANTS.

AT the meeting of the London society of arts held on March 10, Mr. E. Price Edwards read a report of the experiments on lighthouse illuminants made at South Foreland during 1884-85. The experiments show that in clear weather all the lights — electric, gas, or oil — were too good, and that for merely sending an effective beam of light to the horizon on a dark, clear night, no one was really better than the other, although it should be said that the electric light used, on account of its dazzling brilliancy, was regarded as a nuisance rather than otherwise by mariners in the near neighborhood of South Foreland. It is quite certain that for clear weather the lower powers of any one of the illuminants would be sufficiently serviceable for the requirements of the mariner.

The oil and gas lamps were rendered thus effective by superposing one upon another series of flames. It was found, that, in respect to the adaptability of the lights for occultations, — one of the distinctive characteristics used for lighthouses, — gas was especially available, as by simply turning off the supply an occultation is promptly produced in an economic and an effective manner; whereas, with the electric or oil lamp, the use of a revolving screen was found most suitable. For colored sectors, on the other hand, the electric light is most serviceable, as, on account of its small surface, the change in color may be made more abruptly.

The general results of the observations in hazy weather show incontestably that a single electric light greatly excels the most powerful oil or gas light in penetrating-power. In an actual fog the electric also holds its own. The experience of fogs at South Foreland was not large, but was sufficient to furnish available comparisons; and it was proved beyond question that the single electric light pierces a greater depth of fog than the highest power available of either gas or oil, but in heavy fogs the mariner would not derive the slightest advantage from any of the lights used. The recorded distances to which lights were carried, or where they were picked up, in heavy fogs, range mostly from seven hundred to two thousand feet; and the superiority of the electric light is determined by penetrating two hundred or three hundred feet farther than the gas or oil light. The most powerful electric light was shut out on one occasion at fourteen hundred and fifty feet, on another at fifteen hundred, another at seventeen hundred, another at fifteen hundred, and another at thirteen hundred feet. It will be plain to all that no mariner could be benefited by a light which was not visible at such distances from the lighthouse; and, for the purpose of navigation, a difference in the visibility of the lights of two or three hundred feet is of no value whatever.

One fact stands out prominently; viz., the greater ratio of absorption by the fog of the electric rays as compared with that of the gas or oil rays. Fortunately for the electric light, as shown at South Foreland, it possesses a large reserve of initial intensity, which enables it, notwithstanding its much greater proportion of loss by absorption of its more refrangible rays, to penetrate farther than the other luminants. With three lights of equal candle-power, — one electric, one gas, one oil, — exhibited in a foggy atmosphere, there is little doubt that the electric will be eclipsed at a much shorter distance than the others. But as an electric beam can be made so much more intense than it is possible to make the gas or oil beam, the electric light, though heavily handicapped by its competitors, by the very superabundance of its own luminous energy, may be made to penetrate the farther.

The experiments have also shown clearly that the lights from gas and oil are very much alike in illumining-power: indeed, under some conditions, the oil-flames seem to be rather the better. They have also shown that the oil-lights can be superposed with the same facility as the gas-lights. As yet, no oil-flame has been brought to the enormous size of the 108-jet burner; but, as this enormous size of flame is not required, the difficulty is of no great consequence. As the two lights were shown to be so nearly equal, the questions of convenience and economy assume

the greater importance in connection with their relative merits as lighthouse illuminants.

The final conclusion of the experimenters was, that, for the ordinary necessities of lighthouse illumination, mineral oil is the most suitable and economical illuminant, and that for salient headlands, important land-falls, and places where a very powerful light is required, electricity offers the greatest advantages.

METAL-WORK OF THE BURMESE.

BOTH Burmans and Shans are expert blacksmiths, says the Journal of the Society of arts. The latter forge all the *dahs* ('native hatchets') used by themselves and their neighbors in the Hotha valley; and they annually resort to Bhamo, and the villages in the Kakhyen hills, for the purpose of manufacturing them. Their bellows are of the most primitive stamp, consisting of two segments of bamboo, about four inches in diameter and five feet long, set vertically, forming the cylinders, which are open above and closed below, except by two small bamboo tubes, which converge and meet at the fire. Each piston consists of a bunch of feathers, or other soft substance, which expands and fits tightly in the cylinder while it is being forcibly driven down, and collapses to let the air pass as it is being drawn up. A boy perched on a high seat or stand, works the two pistons alternately, by the sticks serving as piston-rods. Charcoal is used for fuel.

The casting of large and small articles in brass, bronze, and other alloys, is much practised, always adopting the method known as *à cire perdue.* First a clay model is made, and coated with beeswax to the thickness of the intended cast, and again covered with an outer skin (two inches thick) of clay mixed with finely chopped straw; this latter coat is provided with funnel-like holes, for pouring in the molten metal, at intervals of four inches, and with straw-holes for letting out imprisoned air. Holes are also provided at the bottom for the escape of the melted wax.

THE GREAT SILVER-MINES OF THE WEST.

VALUABLE indeed have been the scientific results which geology has incidentally received through the great mining undertakings of the west. The studies of von Richthofen, of King, and of Zirkel, on the rocks of the Washoe, have been equally welcome to geologists at home and abroad as contributions to the general principles of their science.

The importance of a thorough and detailed geological investigation of regions possessed of great mineral wealth is at once apparent. The geologist may afford the prospector and the capitalist just that information which is most needed: while, in turn, the shafts and tunnels of the latter supply him with sections and exposures of the rocks, which he could never otherwise hope for. How keenly the advantages of such a combination are appreciated by the government geological survey is abundantly proven by the recent elaborate monographs by Becker on the geology of the Comstock Lode, and by Irving on the copper-bearing rocks of Lake Superior; while others of a similar nature are now in course of preparation on the silver districts of Eureka and Leadville by Messrs. Hague and Emmons. Nor may we pass without mention, in this connection, the extremely important contribution recently made by Messrs. Hague and Iddings to what we know of the influence of heat and pressure in conditioning the structure of an eruptive rock. No such conclusive evidence that the holocrystalline structure of an igneous mass depends upon the slowness with which it solidifies, had ever before been discovered as that which they found in the microscopic study of the rocks displayed in the hundred and eighty miles of shafts and galleries at the Comstock.[1]

But the value of such technical papers can at most be appreciated only by a few. Specialists in the same field of scientific inquiry, or the prospector or miner who consults them in hope of some practical suggestion, will be their only readers, even though the results which they contain are broad and far-reaching in their significance.

Nevertheless there is connected with the development of a vast mining industry very much to awaken a popular interest. The accidental discovery of rich mineral treasures in the heart of a mountain wilderness; the rushing thither in hordes of men of every type, all eager to secure the largest prize; the human ingenuity and energy displayed in overcoming the vast obstacles which nature has placed in the way of transportation; the story of successes and disappointments, of fortunes made and lost, — all this gives scope for the display of the strongest human passions, and contains the elements of a tale whose truth is more romantic and more exciting than fiction.

In a volume[2] quite different in its character

[1] *Bulletin No.* 17 *of the U. S. geological survey.* On the development of crystallization in the igneous rocks of Washoe, Nevada.

[2] *Monographs of the U. S. geological survey.* Vol. iv. Comstock mining and miners, by ELIOT LORD; vol. vii. Silver-lead deposits of Eureka, by J. S. CURTIS. Washington, 1883, 1884. 4°.

from the other monographs which have thus far emanated from the geological survey, Mr. Lord has given an extremely interesting story of the discovery and development of what is doubtless the richest mineral lode in the world, as well as a vivid picture of the life in the town which sprung up with such surprising rapidity beside it. The book is one which can but be read with enjoyment and profit by all, no matter what their idea is of the proverbial dryness of government reports.

On the 15th of May, 1849, William Prouse, a young Mormon, travelling up Carson valley, made the first discovery that gold existed in what is now western Nevada. The region is a barren desert, occupying the eastern slopes of the Cordilleras, too arid to support more than the barest vestiges of life: and yet the report of the few grains of yellow dust discovered there by Prouse was sufficient to attract into it hosts of eager men from already overcrowded California. For ten years prospecting went on in and about what was early named Gold Cañon, with varying success. Sands were washed for gold with profit in many places, but no one as yet suspected the mine of wealth which lay at their very door. In June, 1859, Henry Comstock, a Canadian miner, secured a claim on the side of Sun Peak (now Mount Davidson), and thus impressed his name forever on the richest silver-lode ever opened. Still it was supposed that only gold was to be found, until a fortunate assay of some of the black gangue, which the miners had always thrown away as worthless, showed that it contained $3,000 in silver and $876 in gold to the ton. From this discovery (July, 1859) the development of the real richness of the Comstock may be said to date.

Nothing more was needed to start a vast tide of emigration from California to the Washoe. Over the almost impassable mountain-trail struggled, in the early spring of 1860, the wild rushing mass of humanity, without proper food or clothing. Freight-transportation was almost impossible, and into the desert they hurried, with no thought but to be first at the pile of treasure which all imagined must be awaiting them.

For a picture of the wild life of the mining-camp; of the endless litigation over claims; of the rapid growth of camp to town, and of town to city, as the mines developed; of the almost superhuman feats of energy and endurance in struggling with fire and water and in competition with each other, — we must refer the reader to the work itself. The lode proved richer at every point than the most sanguine prospector had at first imagined. Millions were spent for machinery and in draining and ventilating the mines, and yet the supplies of riches seemed endless.

In 1869 a railroad was actually constructed to this mountain fastness; and just about this time the mines, which had been increasingly productive for ten years, showed their first signs of exhaustion. Many of the old ore-bodies had almost ceased to produce. In 1872 a panic in Washoe mining-stocks ensued, which caused them again to change hands and as rapidly to bring fortune to their possessors. In 1873 was discovered the so-called 'Big bonanza.' No other such enormous mine of wealth has ever been uncovered in the earth's crust. The shafts were sunk lower and lower, but the ore only seemed to increase in richness with the depth. The silver production of the lode, which was fourteen millions in 1866, and six millions and a half in 1870, rose to over thirty-eight millions in 1876.

But of the details of this wonderful tale there is no space to enter here. For its romance and its fact alike we must refer the reader to the vivid descriptions and the statistical tables of Mr. Lord.

The work of Mr. Curtis on the silver deposits of Eureka, which lies to the eastward of the Comstock Lode, in central Nevada, is altogether different in its aim and scope from that of Mr. Lord. It is no story of mining and miners, but a clear discussion, from an engineer's point of view, of the nature and origin of the deposits, and an account of the methods by which they are worked. Only enough geology is borrowed from the forthcoming report of Mr. Arnold Hague to make the occurrence of the ore intelligible.

The deposits are large, irregular masses embedded in a limestone of Cambrian age. This is accompanied by other limestone and quartzite beds of the same and later age, and by acid eruptive rocks. The ores are mainly sulphurets of lead and silver, the former of which, however, has been oxidized down to a certain depth. The deposits occupy caverns in the limestone which they never completely fill.

The author thinks it probable that the rocks were first disturbed by dynamic forces, which crushed the limestone more than it did the other beds. Into this penetrated heated alkaline solutions, coming from below, which deposited the silver and lead sulphides as soon as the conditions of heat and pressure necessary for their solution were removed. There seems to be no evidence that the ore was derived in any way from the surrounding rocks. The only reason why it is found in the limestone is because the more shattered condition of this rock offered more opportunity for the circulation of the mineral solutions. The author also thinks that the cavities now occupied by the ore did not exist before its deposition, but that they were formed by a removal of the

limestone simultaneously with the precipitation of the metallic salts.

In chapter vi. a very interesting comparison is drawn between the silver-lead deposits of Eureka and those of Leadville and other localities in America and Europe, but no exact counterpart of these remarkable ore-bodies is anywhere discovered.

SEWERAGE AND HEALTH.

MR. ERWIN F. SMITH, in the Annual report of the Michigan state board of health, has shown the beneficial effects of thorough systems of sewerage on the health and mortality of cities. The work is based upon a large amount of data, chiefly drawn from European cities owing to the paucity and imperfection of American statistics. The author accepts the system of water-carriage as altogether the safest and best. A comparison of fifteen large cities without sewerage, with as many sewered, shows a remarkable difference in mortality. Thus in the first series the average death-rate was 35.8 per thousand inhabitants, while in the latter it was only 26. One of the most striking instances is that afforded by Chicago, where the death-rate has fallen off from 37.91 to 21.40, with the use of good water-sewerage. In the majority of cases, like results have been observed, and in only a few has the mortality remained unchanged. In England the decrease within late years in general mortality has been, perhaps, most noticeable, and in no country does sewerage receive greater attention. Most especially is there a direct connection observed between good sewerage and typhoid-fever and cholera. In Munich the mortality from the former of these causes has decreased from 1.82 to .17 per each thousand inhabitants. In Berlin, since 1879, the typhoid mortality has fallen off two-thirds; and it was further found, that, out of every 43 non-sewered houses, there was one death, as against 137 houses that were sewered. New York and Brooklyn have the best water-supply and general sewerage system of any of our large cities, and the death-rate from typhoid-fever has been correspondingly low, — in New York, during the last decade, only .28; and in Brooklyn, .15. Contrasting these figures with those of some large non-sewered cities, a remarkable difference is apparent. In Palermo and Turin, with defective water-supplies, the deaths from this cause were as many as 1.2 and .8. In St. Petersburg, without any proper disposition of sewage, the mortality was 1.06 in 1883, and .93 in 1884. It may be well to mention, that, in general, Russian mortality is frightfully high, in some provinces reaching 62 per thousand. With cholera similar results bring the conclusions that unsewered cities suffer severely, while sewered cities escape, and that localities subject to typhoid-fever are the ones likely to be visited by cholera. This last is especially significant, and behooves the earnest attention, at the present time, from American cities where the known typhoid mortality is great. As regards diphtheria, the author concludes from the study of abundant data that there is no direct relation between them. Finally, the author concludes that "it is entirely within bounds to say that the general introduction of proper sanitary measures, meaning thereby the provision of an abundant supply of pure water and the proper disposal of excreta, would reduce the annual loss in the United States from one single cause, the preventable typhoid-fever, in money value, at least $25,000,000 a year, — enough, in the course of a few generations, to sewer every city and village from the Atlantic to the Pacific."

The influence of sewerage and water-supply on the death-rate in cities. By E. F. SMITH. Lansing, *State*, 1885. 8°.

ABBOT'S SCIENTIFIC THEISM.

DR. ABBOT'S purpose is to expound a theory according to which the universe is the direct manifestation of the indwelling thought of God, — "a universe in which the adoring Kepler might well exclaim in awe unspeakable, 'O God! I think Thy thoughts after Thee,' — a universe which is the eternally objectified Divine Idea, illumining the human intellect, inspiring the human conscience, warming the human heart" (p. 214). This theory he regards as the best expression of the outcome of scientific thought, and he accordingly seeks to present his doctrine in close relation to the facts of scientific experience. Science, namely, discovers in the world objective relations, and finds these relations united in more or less completely understood groups or systems; science therefore, thinks Dr. Abbot, properly concludes that the world as a whole must be one rationally comprehensible system of relations. But a comprehensible system of relations is, he affirms, inconceivable apart from an intelligence that creates the system or that expresses itself in this system: hence the world must not only be intelligible, but intelligent; and therefore "the universe *per se* is an infinite self-consciousness" (p. 155). This, in the briefest summary, is Dr. Abbot's positive doctrine.

Organic scientific philosophy. Scientific theism. By FRANCIS ELLINGWOOD ABBOT, Ph.D. Boston, *Little, Brown & Co.*, 1885. 16°.

Nobody with the slightest knowledge of the annals of human thought ought to hesitate concerning where such a doctrine historically belongs, what line of philosophic tradition it represents, and upon what general considerations it must inevitably found itself, in case it gets any sound foundation at all. It is the well-known idealism of Plato, the immanent teleology of Aristotle, the doctrine that the continental schools of modern philosophy have from the first labored to comprehend, and to establish upon a modern foundation, the doctrine *par excellence* of post-Kantian idealism in Germany, and, in general, the contention of objective idealism everywhere: this it is that Dr. Abbot's book has somehow to present to us, and that every serious philosophic student would surely rejoice to find helpfully expounded and defended, with any new shading or emphasis, and with any new and significant method of proof. To the consistent believer in this objective idealism, the novelty of Dr. Abbot's argument must therefore lie — not in the main doctrine itself, which we all know so well and have toiled over so frequently, but in the form of the demonstration. We all are aware that science does undertake to know a real world, full of relations, and rationally intelligible; and all philosophical idealists of any significance whatsoever have been interested, ever since there were any sciences of experience, in proving at least two theses: 1°, that these sciences, in their assurance of the objective reality and thorough-going, rational intelligibility of the world, are absolutely and demonstrably right; and, 2°, that this right assurance, properly interpreted, makes of this real world of science nothing more nor less than the expression of an absolute intelligence, i.e., of an infinite spirit. This effort, we insist, all idealists of any significance have made, in their way and measure, from the first. Dr. Abbot will therefore be greeted by idealists as a welcome ally, if he adds a significant argument of his own.

As to his positive achievements, however, in this main undertaking, we feel no small disappointment. The link between that objective intelligibility of things which science postulates, and that objective conscious intelligence *in* things which Dr. Abbot, like all other objective idealists, wants to demonstrate, is a link that philosophy is bound to find if it can, but that cannot possibly be found, as Dr. Abbot at first undertakes to find it, by any bare experience of the facts of nature. The whole historical outcome of the philosophy of experience has shown that, and Dr. Abbot helps his case no whit by such scholasticism as he later employs, at the top of p. 151, where, having previously told us that scientific experience shows or postulates the universe, or the self-existent, to be 'infinitely intelligible,' he goes on thus: —

"That which is self-existent must be self-determined in all its attributes; and it could not possibly determine itself to be intelligble unless it were likewise intelligent. Self-existent intelligibility is self-intelligibility, and self-intelligibility is self-intelligence; or that which intelligibly exists *through* itself must be intelligible *to* itself, and therefore intelligent *in* itself."

All this, regarded as mere assertion, may be true, and in fact the present reviewer does most potently and powerfully believe it, although he holds it not fitting that it should be thus set down; for, thus set down, this kind of objective idealism is like sweet bells jangled, out of tune and harsh. But regarded not as bare assertion, but as argument, the statements as quoted take the form of an arrant scholasticism, and can convince nobody. Our author, in fact, only *feels* the connection between the objective intelligibility that science postulates, and the objective intelligence that philosophy seeks to demonstrate. He states this his feeling sometimes as a sort of vague inductive argument, to the effect that one has never found any thing but intelligence actually capable of making intelligible systems of things; and sometimes as a scholastic rambling from the word 'intelligible' to the word 'intelligent,' through various intermediate terms. In either form, however, the argument is unphilosophical and antiquated. The objective intelligibility of the world does indeed enable us rationally to conclude that the world contains objective intelligence; but we cannot so conclude through a mere induction, which would at once, like the old forms of the design argument, fall a prey to perfectly obvious sceptical objections; nor yet may we argue by means of a multitude of scholastic terms, and hope in that way to accomplish our purpose. We must take a little more trouble in philosophy than this. We must tread in certain paths of critical argument that Dr. Abbot, with all his idealistic enthusiasm, has studiously and very unphilosophically avoided, although many of them are very old facts in the history of idealism.

Space has forced us to be, we may fear, even discourteously brief in these remarks upon Dr. Abbot's positive doctrine; but, as to his historical and critical introduction to this doctrine, we despair of doing more than to suggest either its scope, or the thoughts that arise in us as we read it. Dr. Abbot is, on the whole, so thoughtful, so enthusiastic, so readable in spite of his terminology, so devout, so high-minded, so terribly in earnest, that it seems wicked impiety to say what

we fancy that nearly every reader of moderately good acquaintance with the history of thought will feel in going over this earlier portion of Dr. Abbot's book. Here is a scholar of undoubted learning and ability, who has himself a doctrine to advance, that, however he tries or fails to prove it, can only be described as the ancient objective idealism of the whole Platonic tradition in philosophy. He spends half his volume, however, in a violent denunciation of all idealists, whose method, he is convinced, could only lead logically to something known as solipsism. He sets over against them, as an example for their better instruction, the progressive realism of science, with its assurance that the world is there and is comprehensible, once for all. With this assurance, he thinks, philosophy must be set out, or else it must remain fruitless dreaming. The third alternative, however, the simple and obvious truth that philosophy rests neither upon an acceptance nor upon a rejection of such assumptions as this one, Dr. Abbot utterly forgets. Philosophy is in fact, at the very start, an effort to *comprehend* these assumptions of life and of science, and therefore cannot possibly begin by simply taking them as they are, unquestioned, just as it cannot possibly begin by casting them aside. It is highly comical, therefore, to find an accomplished philosophical student protesting against all writers who have ever asked *how* an individual consciousness can know a real world, and replying to their queries by the simple repetition of his personal assurance that we *do* know an external world. What, then, is philosophy there for, if not to answer, first of all, just the question, *How?* where common sense has contented itself with a bare *that?* How can a thinker of Dr. Abbot's experience be ignorant of this fundamental distinction between philosophizing about life, and living apart from philosophy? Life makes assumptions, and philosophy critically analyzes them; and that is precisely the cardinal point of difference in question. Now, empirical scientific investigation as such is just one form, though a very highly developed form, of living. It therefore does not reflect upon its own presuppositions. Why should it? But philosophizing is coming to self-consciousness about the foundation of your presuppositions. This work of merciless reflection must of course, in the beginning, take upon itself the sceptical form. Nothing is sacred to it: it is cold, dry, passionless, in spirit and in method. Yet its ultimate aim is not negation, nor yet scepticism, but clear consciousness, and nothing less than clear consciousness. Nobody is bound to pursue such an investigation unless he is so disposed; but for a professional philosopher himself to appear before us, ridiculing the very business of his art as necessarily worthless, produces a strange impression. It is as if a poet should begin by assuring us that all verse is a vain show and a wicked distortion of facts. Yet what else is all this introductory philippic of Dr. Abbot's but an abuse of the philosophers of former ages for having tried to philosophize? "The first objection to phenomenism," he writes, "is that science is actual knowledge of a noumenal universe, and therefore refutes by its bare existence" phenomenism (p. 79). "Noumenism," on the other hand, "is the only just and philosophical interpretation of the scientific method" (p. 127). The scientific method, moreover, is "the true and only organon for the discovery of truth: and the proof of its validity is the rapid progress of actual discovery" (p. 62). However, after all, "the truth of perception cannot be logically proved," as Dr. Abbot with charming simplicity remarks on p. 180, adding, "But if the wonderful increase of human knowledge by the use of the scientific method be not verification of the original scientific hypothesis [i.e., of the existence of a noumenal world], then there is no such thing as verification, and all human knowledge is a melancholy lie." These remarks are sufficient of themselves to characterize Dr. Abbot's not uncommon, but highly amusing state of mind. His philosophy thus rests upon two assertions, whereof the one is the statement that no truly fundamental philosophical reflection is needed at all, since 'the actual existence' of science is a sufficiently fundamental basis for our beliefs; while the other is the equally interesting statement that no fundamental philosophy is even possible, since "the truth of perception cannot be logically proved." The outcome of these two assertions of the uselessness and the impossibility of philosophy, is something that calls itself a 'philosophy of science,' and that announces itself as destined to revolutionize human thought about these matters. Its culmination in the 'Religion of science,' a truly beautiful and pious doctrine, for which of course it can give no sort of fundamental reason, we have already seen. In fine, then, Dr. Abbot's book gives us the positive theory that the objective idealists of the past discovered, held, and tried in a critical and thorough-going way, to demonstrate. This theory Dr. Abbot himself maintains by some very halting empirical arguments, and by a few scholastic word-puzzles. Those objective idealists of the past, however, he meanwhile fiercely upbraids, for that they, the wretches, in their tediously critical fashion, actually tried to get to the bottom of things, to discover fundamental principles, and even to demonstrate with philosophical thoroughness their positive doctrine and

his. The philosophy of the future will not act as they did, will cease to reflect upon the scientific assumptions, will take them merely on faith, with a few hints about the insanity of inquiring into them, and with a little melancholy contemplation of those dark ages when men used even to ask fundamental questions. In brief, the philosophy of the future will not philosophize.

Devotion and enthusiasm in the presence of the greater questions of religion and science are so rare that one rejoices to find any one so enthusiastic and devout as Dr. Abbot. But when he undertakes to discuss the philosophic questions proper, Dr. Abbot, by his ferocious denunciation of the whole past course of modern thought, reminds us of a certain newspaper musical critic, whose abuse of all the better concerts that he chances to attend we often have read with huge delight. The critic in question is, namely, by the will of an evil fortune, as accomplished and scholarly a musician as many years of toil could produce. Unhappily, however, it chances, that, by the will of God, his nature was so constituted that he hates music. The sorrows of this man are hard to conceive. JOSIAH ROYCE.

STOKES'S LECTURES ON LIGHT.

THE singular origin of these courses of lectures was described in this journal (vol. iii. p. 765) in the review of the first. Though by the same author as the first, the subjects treated are far more generally understood by the ordinary reader of scientific literature, and consequently hardly admit of such original treatment as characterized the former book. Of the four lectures here given, the first treats of phosphorescence and fluorescence; while the remainder, with the exception of a portion of the second lecture, which relates to the rotation of the plane of polarization, is devoted to spectrum analysis and its revelations. Perhaps the most interesting passage to the scientific reader occurs on p. 45, relating to the author's claims as an original discoverer of the principles of spectrum analysis. The warm discussions to which this topic have given rise are numerous, and, as is well known, some of the most eminent English writers have attributed the priority of the discovery, without restriction, to Stokes, leaving for Kirchhoff, beyond credit for an independent discovery, only the honor of having extended the method to the detection of elements in the sun other than sodium. Thus Tait, in his 'Recent advances in physical science,' and Sir William Thomson, in the President's address (*Brit. ass. rept.*, 1871). It was the latter which called out Zöllner's vigorous retort and arraignment of English men of science in the introduction to his 'Ueber die natur der cometen.' In this passage, after describing Foucault's observations on the spectrum of the electric arc, the author says, "On this ground, it seemed to me that the substance which exercised the selective absorption in Foucault's experiment must be free sodium. This might conceivably be set free from its compounds in the intense actions which go on in the sun or in the electric arc; but I had not thought that a body of such powerful affinities would be set free in the gentle flame of a spirit-lamp, nor perceived that the fact of that flame's emitting light of the definite refrangibility of D, entails, of necessity, that it should absorb light of that same refrangibility."

Burnett lectures on light. Second course, on light as a means of investigation. By GEORGE GABRIEL STOKES. London, *Macmillan*, 1885. 24°.

IN a recent paper by Prof. S. I. Smith (*Ann. mag. nat. hist.*) on the decapod (crabs, lobsters, etc.) crustaceans from the Albatross' dredgings in the North Atlantic, there are some interesting points brought out regarding the deep-water fauna. An unusually large number — a third — of all the species of decapods obtained were from depths greater than one thousand fathoms, and many of the species were remarkable for their large size. Specimens of one brachyuran had the carapace five inches long and six broad, while others of an anomuran were yet larger, the outstretched legs measuring over three feet in extent. Not only were there many large species, but there was an apparent absence of all small species. Their color was also found to be very characteristic. A few species were apparently nearly colorless, but the great majority were of some shade of red or orange, and there was no evidence of any other bright color. Of twenty-one abyssal species, eight possessed normal black eyes, two had abnormally small eyes, three had eyes with light-colored pigment, while of the rest the function was doubtful. Of five species from below two thousand fathoms, one had normal well-developed eyes, and the others small, imperfect, or doubtful. From these facts, in connection with others, the author concludes, that, despite the objections of physicists, some light probably penetrates even beyond two thousand fathoms; and he thinks, from the purity of the water in mid-ocean, light might reach this depth as readily as to five hundred, or even two hundred, nearer shore. However, he finds that there is an undoubted tendency towards radical modification or obliteration of the normal visual organs in deep-water species. The large size and small number of eggs were also observed as a marked characteristic of many deep-sea decapods.

SCIENCE.

FRIDAY, APRIL 16, 1886.

COMMENT AND CRITICISM.

AN ADDITIONAL ARGUMENT for the preservation and care of the levees of the lower Mississippi is afforded in an unexpected way. For many years great damage to stock, and human discomfort, in those regions, have been caused by small flies known as 'buffalo gnats' (Simulium). Very similar flies, with similar injurious habits, have long been well known in the valley of the Danube and elsewhere; but as the species that have been studied, breed, as a rule, in streams that are clear, rapid. and rocky, it has been a question of considerable importance how the insects bred in such great quantities in the low alluvial Mississippi country, — a question whose solution might, it was hoped, afford a means of checking the increase of the pest. The present spring Dr. Riley, and two of his assistants, Mr. F. M. Webster and Mr. Otto Lugger, have succeeded in determining the habits of the two known species; and it appears that they breed in the more swiftly running portions of the smaller creeks and bayous, which are permanent, and do not dry up in midsummer. They are found attached to the masses of driftwood and leaves, which form at points, and which, by impeding the streams below, form a more rapid current at the surface. The larvae and pupae have been absolutely connected with their respective adults, and a careful study of the general character of the breeding-places already indicates that the increase of the pests of late years is indirectly due to the crevasses in the levees.

DR. SHUFELDT, in a recent pamphlet published by the U. S. bureau of education, calls attention to the needs and shortcomings of anatomical museums in this country, and presents an outline of how such museums should be formed and conducted. The subject is of no little importance, from the fact that we have so few anatomical museums that serve as useful means of instruction, or indeed for any thing except as repositories of anatomical odds and ends and curiosities, of which medical students, as a rule, make no use. One cause of this condition is the general indifference or neglect of comparative anatomy in medical instruction, and the non-recognition of the principle that museums, to be educational, should be largely comparative. The author rightly insists upon greater attention being given to comparative morphology as a basis of medical progress, and censures the lack of system. We are glad also to see his protest against the misleading and expensive dried preparations so common in collections.

BY THE ADDRESS of President Adams before the Cornell alumni at their sixth annual dinner recently held in New York, the controversy over what shall be the character of the university work was revived. Cornell was one of the colleges established through the benefit of the Morrill grant of 1862. The fundamental intent of that grant was the endowment in each state of at least one college where the leading object should be, "without excluding scientific and classical studies, to teach such branches of learning as are related to agriculture and the mechanical arts, in order to promote the liberal and practical education of the industrial classes." The grant to New York consisted of land scrip for 990,000 acres. This scrip was bought by Mr. Cornell for about $500,000, and to this he added an equal sum from his own pocket. The land was located in the timber districts of Michigan, and now, at the end of twenty odd years, has realized to the college some three millions of dollars. The question is, whether the whole of this should be devoted in accordance with the original grant, or whether, on account of Mr. Cornell's additional contribution, and the large amount realized through his foresight, the college is only bound to devote a portion of the fund to education in agricultural and mechanical arts. We would call attention to what our correspondent H. N. has to say upon the matter.

SETTLEMENT OF LABOR DIFFERENCES.

WHETHER the pamphlet[1] from the pen of Mr. Joseph D. Weeks, which the Society for political education has just published, was or was not timed to the present crisis, we are not aware; but,

[1] New York, *Putnam*, 1886. 12°.

coming just at this time, both its value and its influence will be increased. The pamphlet is entitled "Labor differences and their settlement, a plea for arbitration and conciliation," and it is an able exposition of the causes underlying our present labor difficulties, together with an argument in favor of arbitration as the best method for their settlement.

No thoughtful man can have watched the development of labor troubles during the last few years with any feeling short of anxiety. The increase in the number and frequency of strikes, the growing percentage of them that are successful, the hostility and ill feeling too often shown by employers and employed, have all forced themselves upon our notice, but society seems helpless before them.

Much of this, perhaps all of it, is due, we dare assert, not so much to a misunderstanding of the questions immediately under discussion as to absolute ignorance of the conditions underlying those questions, and moulding their form. Philosophy and science have taught us to view society as having developed from its early militant to its present industrial type along certain well-defined lines. But some how or other we feel an irresistible desire to view this process as complete, to consider the book of evolution closed, and to congratulate ourselves on being the summation of an infinite series. This false conception affects our actions. We fail to see that society is still changing and developing, that the laws that operated in the past are still at work.

This crude philosophy enters as a factor into our present labor complications when they are seen from a scientific stand-point. Old theories will not fit new facts, nor will antique remedies cure new troubles. Almost without an exception, employers look upon the employees as their inferiors, and treat them as such. From this follows ill feeling, desire for retaliation, perhaps criminal recklessness. We overlook the fact that the old feudal relation of master and servant is a thing of the past, and is not represented in our present economic organization. As Mr. Weeks acutely points out, discussions between employers and employed are 'permitted' by the former, interviews are 'granted,' committees are 'recognized.' Now, we need not blind ourselves to the ethical fact that there is a superiority of possessions as well as a superiority of physical force and of intellect, but in economic matters it cannot safely be pushed very far. The employers must climb down from this feudal pedestal, and meet their workmen on a level. Before the law and at the ballot-box, every man counts as one, and no more; and it is unreasonable to expect that in economic relations one party to a contract shall count as infinity, and the other as zero.

In the second place, a false political economy must bear its share of the responsibility. The employers have come to think that they pay the wages, and therefore may settle them as they see fit. But the wages question is, as Mr. Weeks says, a problem in distribution, and wages are paid out of the product (p. 11). By a figure of speech, they are paid by the employer, because, as industry is now organized, the product — the result of the combined effort of capitalist and laborer, we must always remember — goes into the hands of the employer as trustee, and he advances to his laborers each one's share as previously determined upon. Perhaps not even the laborer himself understands this clearly. The present methods have been in operation so long and on so enormous a scale, that it is not easy to look beyond them and see what they really stand for.

These two facts are typical of the steps to be taken in settling any labor dispute. The method laid down for scientific procedure by Bacon can find application in the field of industrial problems. First, we must clear our minds of all idols, all false notions and mistaken prejudices as to the inequality of the employer and the employed; and, second, we must observe facts and relations as they are, and not as it may suit our ideas to have them.

It is in these fundamental conditions that labor troubles arise. Strikes, lock-outs, boycotts, and so on, are the effects, not the causes, of labor troubles. By repressing them we are only sitting on the safety-valve. Hidden but potent forces are at work, and as sure as fate they will break out in another place if repressed in one. What we want is prevention of strikes, not a cure for them.

Have we any such prevention to suggest? Yes: we follow Mr. Weeks in favoring permanent boards of arbitration in which employers and employed are equally represented, presided over by a disinterested umpire. The great advantage of a permanent board of arbitration, holding stated meetings, is that it builds up an *entente cordiale* between the capitalist and the laborer. They learn to sympathize with each other, to know that an industrial problem may present two very different aspects from two different points of view; to see, in a measure, through each other's spectacles. The trouble with a temporary board of arbitration is that it is formed after the friction between the two parties has begun. It meets after a declaration of hostilities, not before; and its members, feeling that they have a certain position to defend, assume a semi-belligerent attitude. The theoretical advantages of a permanent board are forcibly

supported by the evidence Mr. Weeks cites from practice. In the hosiery and glove trade at Nottingham, England, a board of arbitration was established in 1860, and since that time not a single general strike nor difference about wages has occurred that was not settled amicably. The iron trade in the north of England has a similar story to tell. The *Conseils des prud'hommes* in France and Belgium bring cumulative evidence.

A coming-together of this kind every month or six weeks, and meeting as equals for the discussion of affairs of common interest and importance, would have a magic effect in ascertaining the facts and suggesting concessions, as well as in removing that false pride and foolish obstinacy that aggravate so much every dispute about labor. The present appeal to brute force is as absurd and worthless as it is antiquated. It is economically and ethically a crime. Knowledge, moderation, and Christian charity will permanently re-organize industry on a plane where the strikes and boycotts of mediaeval inheritance will be unknown.

NICHOLAS MURRAY BUTLER.

APPARITIONS AND HAUNTED HOUSES.

THE committee on apparitions and haunted houses, of the American society for psychical research, have issued a circular to invite communications from persons who may be able to help them in an examination of the phenomena that fall within their province.

They particularly desire information regarding supposed cases of apparitions of absent or deceased persons. It is well known that from time to time there are related or published accounts of people who are said to have seen, as present, persons who were at the time actually either absent or dead. As a proof of the genuineness of these appearances, the accounts frequently add that the persons who have had these experiences have learned, through them, about some otherwise unknown facts, afterwards verified; such, for instance, as death or illness, or some other calamity which has actually happened, at or near the time of the apparition itself, to the distant person whose appearance is narrated. Other proofs of the reality and significance of the supposed apparitions are sometimes narrated.

The committee wish to collect accounts, from trustworthy sources, of all such alleged occurrences, as well as accounts of other similar personal experiences which may have been striking enough for the persons concerned to remember, or perhaps record. Such accounts the committee propose to collate and examine, with a view to drawing such conclusions from them as may seem proper and warranted. In order that the results, if any are reached, may have value, the committee, while not wishing to exclude any information likely to be useful, will be especially glad to hear directly from the persons themselves who have had the experiences in question, with such further information as will enable the committee to verify the accounts given, whether by the accounts of other witnesses, by the use of documents, or by means of other collateral testimony. Persons who have information bearing on the matters before the committee may find the following questions useful guides in stating their evidence. Such answers as can be furnished, in any case, should be given as explicitly as possible, in the communications addressed to the committee.

1. To whom and when did the experience in question occur? What was his (or her) age, nationality, and occupation; and what was his (or her) state of health or of mind at the time of the apparition? At what hour of the day did it appear, and at what place?

2. Had the narrator of the experience in question ever had hallucinations, or seen apparitions before, or has such an occurrence ever happened since? If so, describe these other experiences, giving their time and place, and compare or contrast them with the one in question.

3. Does the narrator believe in ghosts? Or has he, before this experience, believed in apparitions of any sort, as probable sources of knowledge about absent or dead persons?

4. To what senses did the apparition appeal? If it appeared clearly to the eye, describe the color, the form, place, apparent distance, size, clearness, the length of time of endurance, and all other remembered qualities of the object seen. Was it 'as large as life,' i.e., as large as the person or thing supposed to have been seen would naturally have appeared? Were the other objects present at the time (such as the real wall, or a real table or chair) visible through it? Did it stand still, or move about? Did it remain clear, or come and go? Could it be touched? Was it seen in the darkness, or in the light? If the experience in question was not something seen, but something heard or felt, describe it as clearly as possible, and in a similarly definite manner, laying stress on whatever may show exactly what was experienced.

5. If the apparition seemed to give warning, or other knowledge of any future or distant fact, did the narrator relate the incident to any one, or give notice of the warning conveyed, *before* he was able to verify the facts supposed to have been revealed? Did he *record* these facts before he verified them? If so, is the record now extant, or

can it be placed for examination in the hands of the committee? What other persons have heard of this apparition? How soon did they hear of it? Can they now be communicated with? What are their addresses? If possible, transmit their accounts at the same time with the narrative of the one who actually experienced the apparition in question. If two or more had the experience in common, their names and separate narratives should be given. If this is not possible, give their names and addresses.

These questions are not meant to cover all the ground in every case, but only to indicate the information desired, and the most helpful sorts of information. In dealing with all these accounts, the committee will be governed by no pre-conceived theory or prejudice. They wish simply to hear and examine the facts, and to draw therefrom whatever conclusions may prove to be warranted by the evidence. To this end they invite friendly co-operation from all well-disposed persons.

Correspondents may feel assured that their communications will be treated as thoroughly confidential by the committee when specially requested so to treat them.

The committee may be able to devote a somewhat limited time to the personal examination of the phenomena connected with so-called haunted houses, and would be glad to hear of such phenomena from persons in the vicinity of Boston. The fullest details are requested from all who may offer information on this topic.

Communications may be addressed to any member of the committee, which is constituted as follows: Josiah Royce, chairman, Cambridge, Mass.; Morton Prince, M.D., secretary, Boston, Mass.; T. W. Higginson, Cambridge, Mass.; J. C. Ropes, 40 State Street, Boston, Mass.; F. E. Abbot, Cambridge, Mass.; Roland Thaxter, 98 Pinckney Street, Boston, Mass.; Woodward Hudson, Concord, Mass.

FOOD-CONSUMPTION.

THE Massachusetts bureau of statistics of labor devotes considerable space, in its last annual report, to this subject, on account of its vital connection with the condition of the workingman. The author says, very justly, that the food-problem is one of the most important that can engross the attention of the people, and of practical interest to the wage-worker, as much money is wasted in the purchase of food which might be saved by its expenditure in accordance with the results of scientific research. The truth of this is apparent to those who have observed how little the poor understand economy in the choice of foods.

The economic value of food-substances cannot be measured by their money cost, but by the amount and kind of nutritive material which they contain. This material the author divides into three different classes — viz., proteines, fats, and carbohydrates — in addition to the mineral matters, and bases the relative value of food-substances upon the available amounts contained.

The relative physiological values of the nutrients in different foods depend, first, upon their digestibility; and, second, upon their functions and the proportions in which they can replace each other in nutrition. Their accurate physiological valuation is, in the present state of our knowledge, impracticable; but their pecuniary costs are more nearly capable of approximation. From extended and careful comparisons of the composition and market prices of the more important animal and vegetable food-materials, which form the bulk of the food of the people, it is estimated that a pound of proteine costs, on the average, five times as much, and a pound of fats three times as much, as a pound of carbohydrates. Of these, proteine is physiologically the most important, as it is pecuniarily the most expensive, and its cost may be used as a means of comparing the relative cheapness or dearness of different food-materials. Taking the cost of food-materials in New York as a basis, and making allowance for the cost of the other nutrients, the proteine in a pound of sirloin beef at 25 cents is estimated at $1.06; in a pound of mutton at 22 cents, 91 cents; in a pound of oysters at 35 cents per quart, $3.36; in shad at 8 cents, 66 cents; in milk at 7 cents per quart, 53 cents; in wheat-bread at 8 cents, 38 cents; oatmeal and beans at 5 cents, 14 and 15 cents.

The nutrients of vegetable food are, in general, much less costly than in animal foods. The animal foods have, however, the advantage of containing a larger proportion of proteine and fats; and the proteine, at least, in more digestible forms. Among the animal foods, those which rank as delicacies are the costliest. Thus the proteine in oysters costs from two to three dollars, and in salmon rises to over five dollars per pound. In beef, mutton, and ham, it varies from $1.06 to 33 cents; in shad, bluefish, haddock, and halibut, the range is about the same; while in cod and mackerel, fresh and salted, it varies from 75 to as low as 31 cents per pound. Salt cod and salt mackerel are nearly always, fresh cod and mackerel often, and even the choicer fish, as bluefish and shad, when abundant, cheaper sources of proteine than any but the inferior kinds of meat. Among meats, pork is the cheapest; but salt pork or bacon has the disadvantage of containing very little proteine.

Oatmeal is one of the cheapest foods we have; that is, it furnishes more nutritive material, in proportion to the cost, than almost any other. Wheat-bread and rice, on the other hand, are the most expensive, in proportion to their cost, of the staple vegetable foods.

By taking into account all the nutritive substances, it is estimated that 25 cents will pay for .29 of a pound of nutrients in beef sirloin, .40 in round beef, and .92 in neck beef; oysters, .12 to .17; shad and bluefish, about .28: smoked herring, 1.21; cheese, 1.08 to 1.35; milk, .99; wheat-bread, 2.08 to 2.75, etc.

Of course, in the comparative value of foods, their actual physiological use is not unimportant. Foods rich in nutrients may not be readily assimilable, and only physiological experiments can finally determine their actual nutritive value.

From a study of the dietaries of factory and mill operatives, mechanics and other people engaged in manual labor in Massachusetts and Connecticut, the most noticeable features observed were the large quantities of food consumed, especially of animal food and fats. The total amount of nutrients per man per day varies in the Massachusetts dietaries from 690 grams to 1,052 grams; while in the European dietaries the normal range is from 653 to 863 grams. In the European the consumption of fats ranges from 13 to 100 grams, while in the Massachusetts dietaries in no case does it fall below 127, and reaches as high as 304 grams. If common usage in Europe, and the standards which are currently accepted there, are correct expressions of the proper quantities of food and of fat for healthful nutrition, the quantities of total food, of meats, and especially of fats, in the New England dietaries examined, are needlessly large, and in some instances excessively so. The dietaries studied all pointed in one direction, indicating that in this country a large excess of food is consumed, not only by well-to-do people, but also by those in moderate circumstances. This excess consists mainly in meats and sweetmeats, which are expensive, as well as physiologically injurious when consumed in too large quantities.

ELECTRIC LIGHTING IN ENGLAND.

OWING to the restrictions imposed by the act of 1882, electric lighting on any large scale is still a matter of the future in England, and the industry has not developed to any such extent as in Germany, Austria, Italy, or Belgium, and by no means as in this country. Perhaps partly from this interference with the development of a large system of distribution for electric lighting, and partly on account of the existence in England of large country houses in the possession of wealthy owners, the electrical illumination of single houses has been brought to a higher degree of perfection than domestic electric lighting in other countries. Men of wealth have constituted themselves into amateur electricians, the marvels of electricity apparently exerting a captivating influence upon their minds, and its study has been a hobby of many.

The pioneers of domestic lighting in England were Sir William Thomson, Sir William Armstrong, Mr. Coope, Mr. Sellon, and Mr. Charles Moseley. Sir William Thomson used a gas-engine, and worked his lamps directly from the dynamo, not only lighting his house, but also his class-room and laboratory in the University of Glasgow. Sir William Armstrong obtained his power from a waterfall in his ground. Mr. Coope used a steam-engine; and Mr. Sellon and Mr. Moseley relied on secondary batteries, obtaining their power from gas-engines.

The good examples thus set have been followed by many, and at present a great many private houses in all parts of the country are thoroughly and efficiently lighted. In fact, electric lighting is becoming a fashion, and in the opinion of Mr. Preece, as expressed at a recent meeting of the London society of arts, "the only fear of its ultimate general success is its falling into the hands of the inexperienced and ignorant."

Steam, gas, and water power have been satisfactorily used as agents for the production of power. Petroleum has not as yet had a trial in England, and wind is too uncertain to be relied on. Mr. Preece believes that a simple effective steam domestic motor has not as yet been introduced; but in this opinion he was criticised by Mr. Crompton of the Society of arts, who affirms that there are several English engines which could be worked by a gardener or butler as satisfactorily as a gas-engine. But most of the high-speed engines require more technical skill than is usually to be found among the domestics of an ordinary household. On this account the council of the Society of arts has under consideration a plan of offering prizes for the best engines designed to fill the special purposes of providing power for electric lighting. The competition will probably be extended to all classes of engines, — steam, gas, petroleum, or what not.

At present the gas-engines seem best adapted to supply the need. According to the statement of Mr. Preece, 25 cubic feet of gas will give us one horse-power, or eight 20 candle-power glow-lamps, or 160 candle-power all told; but five 5-feet burners will give only 75 candles when

burned in air with ordinary burners. Gas-engines, moreover, are within the intelligence of butlers, gardeners, and coachmen: they are always ready for work, they attain their maximum efficiency at once, and they can be stopped in a moment.

In England the opportunities of using water-power are few and far between. The power of the tide or that of a flow of the river is very small when utilized within the limits of ordinary people. The whole flow of the Thames through London bridge would maintain only 800 lamps. In Scotland, however, the case is somewhat different. There several persons have utilized the water stored up in lakes. Many wonder why the wind is never used; but, apart from its uncertainty and unreliability, there is the fact that the power developed by the best windmills is, on the average, but very small.

After referring to the sources of power, Mr. Preece turned his attention to the dynamo, and claimed that science, since the expiration of the Gramme patent, has converted a crude instrument into the most powerful converter of energy that exists. The forms of dynamo, he said, are being whittled down to two or three recognized shapes; but "as long as the spirit of rivalry is stirred up by competition and emulation, so long shall we have some manufacturer who will make a change for the sake of a change, and who will advertise his wares as the best in the world." Mr. Preece holds that little remains to be desired in the quality or price of dynamos, and that a well-constructed dynamo, kept clean and well lubricated, never overworked, should last a lifetime without much attention except to the brushes and commutator.

It is by means of the secondary battery that regularity and uniformity of current are maintained in isolated installations; and it supplies a reserve of force that renders one free from accident to engine or dynamo. Its early failures disappointed many; but Mr. Preece hopes that it has 'sown its wild oats,' and that it has become a mature, sober, practical instrument. Sir William Thomson writes, "My cells have worked to perfection. It is the greatest possible comfort to us in the house to have the light with satisfactorily equal brilliancy at all hours of the night and day, and every day in the week. I have now cut off the gas at the meter, so that there is absolutely none used in the house. I have no oil-lamps, and have not used so much as a single quarter of a candle within the last three months, and have the electric light in every part of the house where light can possibly be wanted by night or by day." Mr. Preece now uses the secondary batteries, not, as formerly, as regulators to his engine, but f the storage of electricity, charging them durin the day, and discharging them through the lam at night. He maintains that the durability of h cells is most satisfactory, and that he can s no reason why they should not last ten years least.

Of the lamps, Mr. Preece could not chronicle great progress as that of dynamos and secondar batteries, and he held that a good standard glov lamp has not yet been devised. He would pref a 10-candle lamp, working under a pressure 50 volts, and requiring half an ampère: th would mean the absorption of 25 watts, or tw and a half watts per candle. The life of such lamp would not be very great; but, if it we cheap enough, one would not mind frequent r newals. Makers of lamps seem to consider th there is great credit in securing long life; b this may be unfortunate, considering the d terioration of glow-lamps with age, owing to t wasting-away of the carbon and its deposition the glass globe. Mr. Preece would have a lam such that we could afford to give it a 'short a merry life.'

There is felt in England, on account of t small development in the industry, a difficulty obtaining experienced workmen; and in son cases it has been necessary to send nearly t length of the island for men to put in the wir and machinery.

Mr. Preece's estimation of the cost is just twi that of gas; but this, whether too high or t low, seems to be in doubt, and it is certain th the cost is largely dependent upon the extent which the light shall be used. Considerable i patience is felt at the restrictions imposed by t act of 1882, and the council of the Society of a is taking an active part in supporting the measu now before the house of lords, intending to e tend the facilities for introducing electric lightin This act is understood to be under the dire supervision of Lord Rayleigh.

THE PROPOSED FISHERIES BOARD (GREAT BRITAIN.[1]

I AM of opinion that the less the governme interferes with any branch of industry, the bett and that, as a general rule, the cost and troul of obtaining such scientific information as necessary for the successful prosecution of branch of industry ought to fall upon those w profit by it, and not upon the general body of t

[1] Letter in response to a request from the secretary the Society of arts for Professor Huxley's views as to t constitution of a fisheries board.

tax-payers. I do not think that any sane man would propose to establish a government office, composed of chemists and metallurgists, for the purpose of managing the business of the iron-masters.

The case of the fishing industry, however, is peculiar. The different classes of fishermen tend to encroach on one another's liberties; and in the case of sea-fisheries the nation at large is proprietor, and has an interest in their being properly worked. Moreover, beyond the three-mile limit the interests of English fishermen may come into conflict with those of foreigners, and give rise to international questions of great difficulty and delicacy. Hence I have no doubt that some department of the government ought to be in close relation with the fisheries, ought to be able to interfere with them to some extent and under certain circumstances, and ought to be able to institute or undertake such scientific inquiries as may be needful in order to obtain satisfactory data for its action.

My first connection with fishery questions dates back now about a quarter of a century, and from that time to this I have taken every opportunity of urging the formation of a government department, such as I imagine is now about to be established, empowered to deal with the fisheries on these principles.

I think that such a fishery department should —

1. Collect accurate statistical and other information respecting the fisheries of England and bearing upon fishery interests in general, and present a yearly report, to be laid before parliament, based thereupon.

2. That it should be empowered to inquire into grievances of fishermen and suggestions for improvement of the fisheries. Hitherto the only method open to those who were, or supposed themselves to be, aggrieved was to get a royal commission of inquiry appointed. Within my experience, three of these commissions have inquired at intervals af eight or nine years, at great cost of trouble and money, into the same questions regarding the sea-fisheries, and have arrived at practically the same results.

3. That it should have power of inquiry to make orders regulating or restricting acts of fishery.

4. That it should be empowered to obtain such scientific assistance as may be needful.

It is to this last point that the questions addressed to me are more particularly directed; but I could hardly have answered them satisfactorily unless I had sketched forth my general views as to the justification and the limits of state interference in fishery matters. I have had something to do both with science and with administration, and it is in the interest of both that I express my strong conviction that they ought to be kept separate.

The function of the man of science is to ascertain facts, and give advice based upon that which he has ascertained. He may be the most competent person in the world to do that, and, at the same time, wholly unfit for administrative duties. If, again, we consider the four kinds of action to which, I believe, the operations of a fishery department should be restricted, what is the advantage of setting a skilled naturalist to collect and digest statistics, or to draw up regulations and orders, or to weary out his soul in the routine business of an administrative office? What he is wanted for is to act, first, as an assessor in inquiries, and, secondly, as an investigator of such problems as bear directly upon those fishery questions in which the general public is interested. For example, the nation at large has an interest in providing against the practice of unduly wasteful modes of fishing, as tending to the wanton destruction of its property; and I should say that any amount of money bestowed upon the scientific investigation of the effect of some modes of fishing might be well spent.

I am strongly of opinion that the best method of bringing science into its proper relation with the fishery department is that the latter, when it requires a scientific answer for an inquiry, or when it desires that a scientific problem should be thoroughly investigated, should apply to the president and council of the Royal society to nominate a person or persons to undertake the work. That is a course frequently pursued by other governmental departments, and it works very satisfactorily. However, if it should be thought better to have a permanent adviser, or a permanent committee of reference, I see no great objection to the adoption of either of these plans.

But what I desire to repudiate as strongly as possible, in the name and the interest of science, no less than in that of the working fisherman, is the proposal which I see continually pressed in letters addressed to the papers, to appoint a body of scientific men to 'manage' the fisheries. In the first place, the proposition is futile, for anybody who knows any thing about the feeling among the smack owners and working fishermen is aware that they would not listen to such a proposal for a moment. In the second place, the notion that the fisheries want managing by a government office, and that the fishing business, like every other, ought not, as far as possible, to be left to manage itself, is, in my opinion, utterly foolish and mischievous. And, in the third place, if the fisheries were to be thus managed, men of science are no more the right people to be intrusted with

managing fishery affairs than a landsman who happens to be master of the theory of navigation is the right man to be trusted with steering an ironclad.

The whole lesson of my somewhat lengthy and varied experience of fishery matters may be summed up thus: —

1. Don't meddle, unless you have good grounds for believing that you know what the effect of your meddling will be.

2. Listen to all that the scientific men without practical knowledge and the practical men without scientific knowledge have to say, but give to neither the power of directly interfering with such a large and important branch of industry as fishing.

3. Collect all the information that is to be had, so that the country may know year by year how the fisheries really stand; make that information accessible to the people who are engaged in the fishing industry; inquire into real or supposed grievances; and regulate or restrict, experimentally, on good cause shown.

4. Let the department charged with these duties obtain such scientific help as is needful from persons of recognized scientific competency, who are not under the control of the administrative department, and are not responsible to any one for the conclusions at which they may arrive. Moreover, let all scientific inquiries thus undertaken be strictly relevant, not merely to fishery matters, but to questions with which the state may properly deal as the representative of the general interest.

If the government is to be asked to give a body of scientific men a roving commission to inquire into the natural history of the seas and rivers of England, let that issue be put plainly before the minister to whom the application is made. But I do not see what the board of trade has to do with such 'aid to science,' nor why it is desirable that the gentlemen who are to be intrusted with this very considerable enterprise should have the 'management of the fisheries' — which means the power of meddling with a great industrial interest — thrown in as a sort of *hors d'oeuvre*.

T. H. HUXLEY.

March 20.

EXPLOSIONS IN COAL-MINES.

ATTENTION has been called to the connection which exists between gas-explosions in coal-mines and certain atmospheric conditions, which is expressed by saying that the number of such explosions is very considerably greater under low atmospheric pressure (under so-called barometric depression) than with a normal or high barometer. This is not a newly discovered fact, for it was recognized by Dickinson as early as 1852; and for nearly ten years past barometers have been used in many English coal-mines for observing the condition and changes of atmospheric pressure, and estimating therefrom, to some extent, the danger which may come from the latter source. But there is a growing conviction that the whole question needs further investigation, and particularly that experimental tests are necessary. Such tests, however, are very expensive, and for that reason little has been done hitherto in that direction. All the more noteworthy, therefore, are the numerous experiments which were undertaken last summer at the mines of Archduke Albert in Karwin, and which were on such a scale that the working of the entire mine was suspended at times in order to give a free field to the scientific investigations. Professor Suess has recently given an account of these important investigations in the geological institute at Vienna.

The district in which these observations were made comprises the greatest part of the archducal Gabriela mine. This portion obtains its fresh air from the Gabriela shaft, while the principal air-shaft, 500 metres to the west, serves as the up-cast shaft. At the latter a Quibal ventilator of 7.04 metres diameter was in operation during the whole course of the experiments. A similar ventilator of 12 metres diameter has been introduced recently.

The seams of the Gabriela mine belong to the most easterly portion of the Ostran-Karwin district, just on the edge of the Carpathian Mountains; and the mine joins the district of the Johann-Schacht where the accident of March 6, 1883, occurred. The stratification is nearly horizontal. On one occasion, after work in the mine had been stopped for six hours, the freshly exposed surface, where the miners had been at work, gave a crackling, blowing, and slightly hissing sound over its whole extent; and the escape of gas was detected not only by the lamp, but by the ear. Many of the puddles of water on the floor of the level were in slight agitation from the gas bubbling up through them. The old surfaces, however, were quiet, and experience has shown that the portions of the seam lying nearest workings lose their gas sooner or later, and cease to be dangerous. For the reason above explained, also, the working of drifts running directly into the seam requires the greatest precaution, and in the whole Ostran-Karwin district double workings are carried on in the deep levels for the sake of ventilation. The escaping gas is carried along by the draught produced by the ventilation, but local accumulations are unavoidable.

In order to obtain clear and convincing results in the investigations under discussion, a long series of analyses of the air from the well and regularly ventilated mine was made at the same time that barometric observations were taken. For the latter purpose a barograph was placed in the lowest part of the mine, at a depth of 230 metres, and the close correspondence between the changes of pressure at the surface and in the mine was ascertained. There a large number of daily analyses were made of the air taken from the ventilator, and also of air taken from a level in the seam by an independent apparatus.

These experiments were commenced in the beginning of June, 1885, and are still going on. The first report published by the archducal finance director in Teschen, based on the experiments made from June 5 to July 13, shows, that, when the barometer fell, the proportion of explosive gas in the ventilator and mine increased. The later experiments confirm this result in the most striking manner. The report referred to expresses the results of the early experiments as follows: —

1. The proportion of explosive gas in the mine air, generally speaking, decreases with increasing atmospheric pressure, and increases with a decreasing pressure.

2. The proportion of gas increases more rapidly the more suddenly the barometric curve falls, and decreases more rapidly the more suddenly the curve rises.

3. The development of the gas does not depend on the absolute amount of barometric depression.

4. If the barometric curve ascends at first suddenly and then slowly, or remains stationary for some time after reaching a maximum, a slow increase of gas is observed. If, after a sudden fall of the barometer, the pressure continues to decrease slowly, or remains stationary some time after reaching a minimum, a slow decrease of gas is observed. The maximum and minimum of the barometric curve, therefore, do not always correspond to the minimum and maximum of the gas curve.

Not content with these observations, a further series of experiments was undertaken. Work on the mine was stopped, and the air-supply shaft was closed while the ventilator was kept running. This experiment was begun at noon on June 20, and continued twenty-seven hours. In order to obtain the usual number of revolutions of the ventilator, the steam-pressure had to be increased. The barometric pressure in the mine sank 2.2 millimetres in five minutes, while the proportion of gas at the ventilator (which was ventilating other workings at the same time) rose to 0.83 per cent, and, at the level where separate collection was made, to about 0.40 per cent. In subsequent experiments a barometric depression of 4 millimetres was reached in the mine, the ventilator stopped, and in one case the gas in the level reached 1.35 per cent. This artificial depression of from 2.2 millimetres to 4 millimetres is certainly small in comparison with the natural variations in atmospheric pressure which are going on all the time, but its sudden production accelerated proportionally the flow of gas in the mine. Of the five severest accidents in coal-mines which have happened recently, four occurred during periods of especially low barometer. The accident at Polish Ostran on the 8th of October, 1884, occurred when the barometer sank 11 millimetres in forty-eight hours. The explosion at Karwin on March 6, 1885, took place on the second day of the fall of the barometer, which lasted three days and amounted to 16 millimetres. That at Saarbrücken occurred also on the second day of a fall of about 13 millimetres; and that at Clifton Hall on June 18, 1885, took place at the beginning of a fall. The accident at Dombran on March 7, 1885, is generally attributed to coal-dust. To these five accidents must now be added that at Spekul in Banat, which took place at nine o'clock in the morning of Oct. 29, 1885. In the absence of more accurate data, it may be remarked that on the 28th of October the barometer was 754.2 millimetres at seven in the morning, at Hermannstadt; on the 29th it was 750.6 millimetres, and on the 30th 749.8 millimetres.

It is superfluous to enlarge upon the experiments at Karwin. They confirm the views of the English experts and those expressed by Cowen before the English parliament in 1878, and it may be presumed that they will produce a change of opinion in other countries where those views are not known. They show the great importance of the barometer in coal-mining. The isobar-charts, which are obtaining a wider publication every year, show the daily progress of barometric minima over Europe, and they should be consulted in future by the managers of every coal-mine. The order is already in force at Karwin, forbidding blasting at all dangerous points on the approach of a barometric depression, and, if the danger increases, all work is to be suspended. M.

NOTES AND NEWS.

Dr. Palisa of Vienna detected still another small planet, April 5: it was of the thirteenth magnitude, and will bring the total number of these bodies up to 257.

— The national museum has received a fine speci-

men of a ten-foot gray shark of strange form, of the Mediterranean species, — the first one of its kind ever taken in American waters. It was caught on the Carolina shores by the life-saving crews.

— Dr. E. M. Crookshank, in a recent paper on the cultivation of bacteria (*Journ. roy. micr. soc.*), describes and figures a peculiar fungus, Actinomyces (or the 'gray fungus'), the cause of a singular disease known as actinomycosis, occurring rarely in man, but not uncommonly in cattle. The fungus is believed to gain an entrance to the animal by the mouth, through the food, or possibly through the medium of a wound of the gums or a carious tooth. It sets up inflammation, resulting in the formation of a new growth, resembling a tuberculous nodule, which eventually terminates in large tumors. In cattle the lower jaw is usually affected, and then the upper jaw and neighboring parts, but the parasite may also occur in the lungs and the subcutaneous and intermuscular tissue. In man the pulmonary formations tend to break down early, forming fistulae and sinuses. In other cases the disease may originate in the intestines, or occur in the bones and other tissue. It may be transmitted by inoculation among cattle and rabbits, and presumably to man. The fungus is visible to the naked eye, appearing in the form of rosettes composed of club-shaped elements, and either colorless or of a yellowish or yellowish-green tinge.

— A recent communication, by Dr. Macgowan, to the China branch of the Royal Asiatic society, in relation to a supposed ancient phonograph, has elicited articles on the subject from several correspondents of the *North China herald*. The instrument to which Dr. Macgowan referred is known as 'the thousand-li speaker,' and is described by a writer of the seventeenth century. A correspondent of the *North China herald*, writing from Pekin, quotes from the 'Things of which Confucius did not speak,' and describes the instrument as follows: "It was a bamboo tube covered with a disk of glass and opened by a key. After speaking into it several thousand words, it was closed and carried to a distance not exceeding a thousand li. On opening it and applying the ear, a voice was still distinctly heard. If carried a greater distance, the voice became indistinct." Although the existence of such an instrument as a phonograph in China, in the seventeenth century, may be doubted, it is interesting to note one suggestion of Dr. Macgowan's. A thousand li in China is a considerable distance, and travelling in carts, or on horseback, over such abominable roads, is by no means a pleasant pastime; and it is probable, that, from the jogging and bumping up and down sustained by the instrument, its mechanism would become disarranged, and the imprints on the metallic plates (if there were such) effaced, before a thousand li were travelled over. So long a distance, therefore, would be sufficient to cause the 'voice within the tube' to grow indistinct.

— Under the name of 'crystallized hopeine,' the *Chemical news* states that a substance is sold, having a slight odor of hops, but which has in its appearance, its crystalline form, and in all its reactions, a close resemblance to morphia.

— Contrary to the ordinary experience with copper salts, M. du Moulin, says the *Chemical news*, has succeeded in administering doses of half a gram to one gram of basic copper acetate to dogs and rabbits for six weeks without producing poisoning. Copper oxide and carbonate have also been administered to rabbits for a year without producing any appreciable injury.

— The French association for the advancement of science will hold its fifteenth meeting at Nancy, Aug. 12 next, under the presidency of Professor Friedel.

— The total amount of diamonds discovered in the diamond-fields of South Africa in 1885 is estimated at not less than 2,440,788 carats, valued at over twelve millions of dollars. The quantity is greater, but the value less, than the finds for the years 1883 and 1884. In 1884 the most valuable diamond now known was obtained, weighing, when first discovered, four hundred and fifty-seven carats, but which will be reduced, by cutting, to two hundred carats.

— Gambetta's brain was stated by Mr. A. Bloch, a few months ago, to be of unusually small size, weighing only 1,160 grams or 38.4 ounces. At the meeting of the Société d'anthropologie of March 18, Professor Duval added, further, some interesting details of its conformation and structure. In comparison with brains of subjects who were known to have been of deficient mental powers, such as possess only a feeble development of the third frontal convolution, Gambetta's brain was found to have an extreme development of this convolution, and the fissures very numerous and very complicated. This development furnishes confirmatory evidence of Broca's discovery of the localization of speech in this convolution. In addition to other peculiarities, the right quadrilateral lobe was found to be very complicated, with numerous fissures in its lower part; and the occipital lobe was extremely reduced, especially on the right side.

— Anent the opinion of Mr. Perry, that a max-

imum of earthquakes is coincident with the mean perigee, Dr. D. J. Macgowan recently submitted the following statistics to the Seismological society of Japan. They partially confirm also Professor Milne's observations that cold weather furnishes the maximum of frequency. Of 738 continental shocks, there occurred, in the

1st	month,	65	7th	month,	70
2d	"	82	8th	"	70
3d	"	72	9th	"	56
4th	"	49	10th	"	43
5th	"	46	11th	"	65
6th	"	63	12th	"	88

The first day of the first month occurs about Feb. 6, or at the new moon which falls nearest to the point when the sun is in the 15th degree of Aquarius. On these seismic records, the Chinese seldom designate the day of the month (moon) when earthquakes occur, yet a considerable number may be found. Seventy-two cases show twice as many in the first and second as in the third and fourth quarters of the moon's phases,—forty-eight in the former period, and twenty-four in the latter. The sixth day shows the largest number, 12; none took place on the 2d, 5th, 13th, or 14th; one occurred on each of the following: 4th, 7th, 17th, 20th, 22d, 23d, 24th, 28th, 29th. Hours are rarely given: so far as they go, they show that a large majority are nocturnal.

—The third annual report of the Massachusetts agricultural station deals chiefly with feeding-experiments and experimental researches upon the use of fertilizers, and the relative nutritive characters of prominent farm-crops. It contains a considerable amount of matter that will be of value to the agriculturalist.

—The well-known embryologist of the fish commission, Mr. John A. Ryder, is now engaged in studying the development of the mud-minnow (Melanura limi), and finds some remarkable amoeboid movements of the eggs before they are hatched. This is somewhat peculiar, and is the first time that it has been observed. By a series of ingenious contrivances, he is enabled to watch the process of development from the moment the fish is hatched until it assumes the characters of the adult.

—The London *Athenaeum* announces that Sir Henry Roscoe will probably be the president of the British association for 1887, when the association will hold its meeting in Manchester.

—Dr. W. N. Bullard, in a paper lately read before the Massachusetts medical society, gives a detailed analysis of the various symptoms of tea-poisoning, obtained from the study of a large series of cases. He arrives at the important conclusions, that the action of tea is cumulative, and is more pronounced on the young and those in a depressed physical condition, although persons otherwise healthy not infrequently show poisonous symptoms; that as a rule in the class of people examined by him, chiefly adult women, the average amount needed to cause poisonous symptoms was a little less than five cups daily; and that chronic tea-poisoning is a frequent affection, whose most common symptoms are loss of appetite, dyspepsia, palpitation, headache, vomiting and nausea, combined with nervousness, and hysterical and neuralgic affections, frequently accompanied by constipation and pain in the region of the heart.

—It has now been determined, says the London *Graphic*, to deal in a somewhat new manner with the difficult problem presented by the disposal of London sewage, which was a few years back considered solved by the simple process of emptying it into the Thames. For some months experiments have been made on what is known as the precipitation method; that is, the sewage is left in a tank until its solid portion separates, the separation being hastened by the addition of lime and protosulphate of iron. Hitherto a million gallons a day have been dealt with, but it is now determined to increase the plant so as to deal with nine times that quantity of sewage. Under this treatment the liquid portion becomes as clear as fresh water, and can be emptied direct into the Thames. The solid portion, or sludge, will be pressed into blocks resembling so much clay, and will be taken out to sea, to be discharged in deep water, where it can do no harm.

—According to Dr. E. Naumann, the director of the geological survey of Japan, the principal coal-deposits in the country are found in Kinshin and Yesso. The most productive coal-mine is that at Takashima, at which mine the daily production amounts to 750 tons. The mine of next importance is at Mûke, which produces about 500 tons. The coal-fields at this spot are supposed to contain 150,000,000 tons, and it is probable that in the future Mûke will become the principal coal-mine of the country. The production of coal in Japan during the year ending June 30, 1881, was 890,000 tons.

—At the congress of German physicists next September, there will be an exhibition of scientific photographs, to which all foreign scientists are invited to contribute, especially astronomers, spectroscopists, geologists, botanists, zoölogists, surgeons, etc. Further information may be obtained by addressing Dr. H. W. Vogel, 124 Kurfürstenstr., Berlin, W.

—The subject of an interesting paper by Mr.

Victor Mindeleff at the last meeting of the Washington anthropological society was 'The snake-dance of the Moqui Indians.' His paper was supplemented by the remarks of Dr. H. C. Yarrow, who visited New Mexico last summer for the purpose of studying in detail this peculiar and somewhat remarkable ceremony. This dance of the Moquis is, according to Dr. Yarrow, a prayer or supplication to their deity for rain. It is conducted by a secret order known as the Antelope and snake men. Snakes are employed under the belief that they are the sacred guardians of the clouds. The snakes used are largely venomous species (mostly rattlesnakes), although three or four harmless species were identified by Dr. Yarrow. Strange as it may seem, the Indians are seldom bitten, although they handle them with the utmost impunity. Painted in the most hideous and fantastic fashion, each participant catches a snake about the middle of the body with his teeth, and holds it in this position while he performs the dance. For several days previous to the ceremony, the snakes are taken through a course of treatment, which consists in stroking them repeatedly, and causing them to drink a decoction of some plant which they claim to be an antidote to the venom of the snake. This treatment renders them somewhat stupid and sluggish, which, in all probability, accounts for the few casualties which occur, although Dr. Yarrow saw rattlesnakes brought in fresh from the plains during the ceremony, and employed in the dance. Their non-combativeness can then be explained, he thinks, only upon the hypothesis of some hypnotic influence exerted by the attendant. An elaborate report on this subject by Dr. Yarrow will be published by the bureau of ethnology.

— Mr. Alvan Clark received April 9, from the Russian minister in Washington, the gold medal awarded to him a year ago by the emperor of Russia on recommendation of Otto Struve, the astronomer at Pulkova, who has charge of the great telescope made by Mr. Clark for the Russian government. The medal is of solid gold, 3-16 of an inch thick, and 3 5-8 inches in diameter. On one side a handsomely engraved wreath of oak-leaves encircles the words '*Praemia digno*,' and on the other side is a profile likeness of the emperor, surrounded by the inscription, 'Alexander III. *Totius* Russiae imperator.'

— The first annual report of the Montreal botanic garden gives a list of the known gardens of the world, from which it appears that there are one hundred and ninety-seven, the most of them, it is believed, scientific in character. Germany has the largest number, — thirty-four; Italy, twenty-three; France, twenty; Great Britain and Ireland, twelve; West Indies, six; and the United States, five. More than half of all are supported by the state, and only about five per cent by private enterprise; the remainder, by the city, and educational institutions. Nearly ninety per cent are free to the public, and more than two-thirds are open on Sundays. The one at Montreal will include about seventy-five acres, although only about eighteen will constitute the garden proper, within which will be the various buildings, pond, and all the beds of herbaceous plants.

— Mr. Brayton Ives, formerly president of the New York stock exchange, and well known as a collector of books, has written a preface for the American edition of Mr. George Rae's work, 'The country banker; his clients, cares, and work,' which Messrs. Scribner have just issued. As Mr. Bagehot's 'Lombard Street' pictured the life and cares of the city banker, Mr. Rae's describes the not less interesting life of the country banker.

— Now that the time is approaching when sail-boats, great and small, are to be put into commission, Messrs. Charles Scribner's Sons' announcement of a practical 'Boat-sailer's manual' is very timely. The author is Lieut. Edward F. Qualtrough of the navy. He has made a complete treatise on the management of sailing-boats of all kinds, and under all conditions of weather; containing, also, concise descriptions of the various rigs in general use at home and abroad, directions for handling sailing-canoes, and the rudiments of cutter and sloop sailing.

— Mr. Andrew Carnegie's new book, 'Triumphant democracy,' will be published on April 17.

— The Numismatic and antiquarian society of Philadelphia has undertaken the preparation of an archaeological map to embrace the valleys of the Delaware and Susquehanna rivers, and desires co-operation in this important work. The map is intended to show the location of all the principal remains attributed to the Indian tribes who formerly occupied these regions. It will include contiguous portions of the states of Pennsylvania, New York, New Jersey, Delaware, and Maryland. Societies and individuals are earnestly requested to furnish whatever information they may possess concerning the following classes of antiquities: gravel deposits (paleolithic); artificial shell-heaps; cave retreats; encampments or village sites; earth-works; old fields; quarries; work-shops; surface deposits of implements, or caches; large rocks in place, used as mortars; rock inscriptions (*in situ*); burial-places; tumuli, or mounds; Indian trails. A full description and accurate location of any of the above should be

given. How far and in what direction from nearest town? On or near what stream, if any? On whose property? The occurrence of native objects of copper, or articles of European introduction, should be mentioned. Communications may be addressed to Henry Phillips, jun., secretary, Philadelphia.

— Naturalists will be pleased to learn of the early publication of Mr. Scudder's extensive work on New England butterflies, which has been nearly completed for a number of years. Those who have seen the elegant colored plates, and are aware of the thorough monographic way in which each species is treated, will appreciate the value of the work. The author is desirous of obtaining additional material for the illustration and description of the earlier stages of a number of species, and will welcome any assistance that may be afforded him in diminishing his list of desiderata.

— Hardly a week passes without the announcement of some new literary or scientific enterprise from Germany. This time it is the appearance of the opening number of a *Zeitschrift für assyriologie* that we have to announce. It is published by Schulze at Leipzig, and Assyrian scholars speak very highly of the part just issued.

— Lea & Son's 'Encyclopaedia of dentistry,' an important work on odontological science now publishing, will contain extended illustrated articles on the teeth of vertebrates, both fossil and recent, and of invertebrates,— on the former by Mr. J. H. Wortman, and on the latter by Mr. W. H. Dall.

— William Paul Gerhard's 'A guide to sanitary house-inspection' (New York, *Wiley*, 1885) will serve as a comprehensive *vade mecum* for the house-holder and house-hunter. It contains succinct and complete instructions for the sanitary inspection of city and country dwellings, and for the choice of their surroundings. Much of the contents common sense and common prudence ought to suggest to the intelligent person; but, unfortunately, common sense and common prudence in sanitary matters are not usually the attributes of the ordinary householder, nor indeed frequently of the educated one, as witness a case of a city physician in good practice who failed to discover in many months that the sewerage connections of his house were untrapped. For those who cannot employ an expert, this book can be recommended as a useful guide in building or in the choice of dwellings.

— Mr. W. T. Hornaday of the national museum will shortly issue his second book, 'Canoe and rifle on the Orinoco,' being a history of his hunting and exploring experiences on that river.

— There has recently been issued by Cupples, Upham & Co. of Boston a pamphlet on the present condition of electric lighting, written by one N. H. Schilling, Ph.D., purporting to be a report made at Munich, Sept. 26, 1885. To whom this report was made is not stated in the volume; but from the statement made at the bottom of p. 5, that 'no business loss has been sustained by us' by the introduction of electricity for lighting the Munich railway-station, "since gas-motors are used for the production of the current," it is natural to suppose that the report was made to one of the gas companies of that city. Similar references occur on other pages, and the report cannot, therefore, be considered an unbiassed statement of the present condition of electric lighting.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Preliminary description of a new squirrel from Minnesota (Sciurus carolinensis hypophaeus[1] sp. nov.).

ONE of my mammal collectors has recently sent me from Sherbourne county, Minnesota, a number of specimens of the gray squirrel of that region. The locality is considerably north of the supposed northern limit of the animal's range, and the specimens differ markedly from the previously described varieties of the species. They are as large as, or slightly larger than, their nearest ally, Sciurus carolinensis leucotis, with which they agree in the size and bushiness of the tail and in the color of the upper parts. They differ from it, 1°, in having broader ears, the convexities of which are adorned with large and very conspicuous white woolly tufts, the yellowish-buff being confined to a narrow strip along their anterior borders; 2°, in having the white of the under parts very much restricted. The color of the back and sides encroaches everywhere upon the belly, leaving a small and irregularly defined patch of white in the centre of the abdominal region, and even this is usually much mixed with gray. The breast and throat are grizzled gray, more or less strongly suffused with yellowish fulvous. The pelage is noticeably softer and denser than in the common gray squirrel.

C. HART MERRIAM.

Names of the Canadian Rocky Mountain peaks.

I willingly admit the inaccuracy of the correction as to the names of some Rocky Mountain peaks made on my authority by Mr. Ernest Ingersoll in *Science* (vii. No. 165): Had I supposed that Mr. Ingersoll would have thought it worth while to publish any note on the subject, I would have been more precise in specifying the names to which it should apply. Mr. Ingersoll, in his original article, wrote (*Science*, vii. No. 162), "Many of the principal peaks in this part of the range were long ago named Balfour,

[1] Υπόφαιος: ὑπό, below; φαιός, dark — in allusion to the dark color of under parts.

Forbes, Hooker, and Brown, by the lamented botanist Douglas, after English men of science." Of these names, Balfour and Forbes were given by Dr. Hector; Hooker and Brown (as pointed out by your correspondent A. G.), by Douglas. Besides Mounts Balfour and Forbes, Dr. Hector, in 1858–59, attached the names of scientific worthies to a number of peaks in this part of the mountains. Amongst these are Lyell, Richardson, Murchison, Lefroy, Bourgeau, and Sabine. Some of the peaks so named are visible from the line of the Canadian Pacific railway. The names, not only of Douglas himself, but also those of Drummond and Hector, deserve to be perpetuated in connection with this part of the mountains, and in a map (the result of explorations by the geological survey) now in course of preparation for publication these will appear. GEORGE M. DAWSON.

Ottawa, April 10.

Science at Cornell.

The undergraduates of Cornell university are becoming agitated over the question whether that great institution is becoming a technical school. Three-fourths of their number are in non-technical courses, and that in an institution the fundamental law of which declares that it is founded and receives its endowments for the specific purpose of promoting agriculture and the useful arts. But so serious a question is this, that the president, in his remarks at the alumni dinner at New York recently, considered it necessary to assert his conviction that enough had been done for the technical departments, and that the endowments and income of the university should be directed to the establishment of law and other schools apparently never contemplated by the founders of the institution, or authorized by the law and the charter.

The chance remark of Mr. Cornell, that he would found an "institution in which any person can receive instruction in any study," and the fact that the value of the endowment, as given by the general government, was, at the time of its presentation, but a fraction of the amount since realized from it, are made the basis of an ingenious argument for the restriction of the appropriation for agriculture and the arts to half a million dollars; while the remainder of the endowment, amounting to several millions, should be, in the opinion of the successor of Andrew D. White, devoted to other purposes.

Where are the traditions and the law and charter of Cornell? and where are the trustees and constituency, which have been hitherto regarded as the defenders of this great trust, instituted for the benefit of the people and the technical education of their sons and daughters?

The fact seems to be, as shown in this address, that the gift of the general government, presented to the state of New York for the purpose of founding and maintaining technical colleges, originally in the form of land-scrip, and worth, as stated, some six hundred thousand dollars, was, by carefully locating the land and by persistent 'holding on,' finally made to produce several millions of dollars, and to form the main dependence of this university, in which the 'leading objects' are prescribed to be "to teach such branches of learning as are related to agriculture and the mechanic arts." But it has evidently required some ingenuity, not to say sophistry, to find an excuse for turning the magnificent grant of the United States into a law school, a school of medicine, or a school of divinity, as speakers at the Cornell dinner are reported to have proposed. It would seem to the outside looker-on that the original provisions of the law and the charter, which have been above quoted, and which further allow scientific and classical studies to be taught, nevertheless must stand, despite the efforts and desires of those who have no knowledge of, or sympathy with, technical education, and that all gifts, from whatever source, should be subject to the fundamental law.

That Cornell should become a true university, in the sense that it should embrace colleges of all the branches and departments coming within the scope of its charter, as far as is possible consistently with the original objects of its foundation, is evidently desirable, not only in itself, but also for the purpose of lending assistance to the students in these 'leading branches,' who have the ability and the desire to become liberally educated; but that such a foundation should be diverted to law, or medicine, or divinity schools, seems preposterous, and it is a question whether the university may not forfeit its charter should such counsels prevail. There are many other institutions in the state of New York looking with wishful eyes upon the grand endowment of Cornell.

H. N.

A convenient way of indicating localities upon labels.

In the careful working-up of a local flora or fauna it becomes necessary to indicate many localities which have not well-known names. This is commonly done by means of more or less lengthy descriptions of the locality. But this plan involves much labor, and is also undesirable from the fact that the data can be attached to the specimen only by means of cumbersome labels, or by reference to a note-book. To avoid these objectionable features, I have devised a system which meets the desired end in a simple manner. This system was suggested to me by the way in which the position of localities are indicated in the city of Washington.

For the purposes of our local survey a well-known point on the university grounds is taken as a centre. Upon a map of this locality, a north and south line and an east and west line are drawn through this point. These lines are marked *O*. Other lines are drawn parallel to these lines, dividing the map into squares, each line indicating a distance of one kilometre. These lines are numbered, beginning in each case at the one next the zero line, and reading towards the margin of the page. By means of roads, streams, and other conspicuous objects, the position, upon the map, of any locality, can be easily ascertained; and its distance north or south of one zero line, and east or west of the other, seen at a glance. It is only necessary to write figures indicating these co-ordinates upon a printed blank label to accurately indicate the locality. This label should have printed upon it the name of the centre of reference; it may also have letters indicating two of the cardinal points of the compass. In the latter case four sets of labels would be necessary. The following is an example:—

Cornell U.	This filled out might	Cornell U.
N. E.	read as follows:	N. 23, E. 16½.

J. HENRY COMSTOCK.

Entomological laboratory, Cornell university, April 8.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 16, 1886.

INVENTORY OF PHILOSOPHY TAUGHT IN AMERICAN COLLEGES.

In the general overhauling which the college curriculum has been receiving of late, there has been one subject quite generally overlooked, — that of philosophy. Apart from an occasional editorial note in the columns of *Science*, I have seen next to no allusion to the matter. Yet it is difficult to see how we are to develop a high grade of national culture in science and in literary matters without contact, by way either of stimulus or of mirroring, or of both, of these matters with philosophic principles. Where this contact is to occur, unless in college, it is also difficult to see. I have no intention of discussing these matters here; but I wish to give an inventory of the present condition of philosophic instruction in our colleges, based upon the catalogues of these institutions. Neither my knowledge nor the limit of space allows me to go beyond a consideration of the subject taught to discuss methods, etc.

The philosophic discipline of the ordinary American college is a survival of that period of its existence when its especial deed was to furnish to the community well-fortified ministers of the gospel. The catalogues of our colleges reveal all stages of evolution from this original source, but all show their genetic connection. The extent of the evolution may be shown by considering the courses of four of the older New England institutions, selected from as many states. In Dartmouth the instruction begins with a twenty-four-hour course in natural theology, followed by twenty hours of anthropology. The *piece de resistance* is sixty hours of psychology (Porter's 'Elements'), which is supplemented by courses in ethics (twenty-five hours), history of ancient philosophy (twenty-six hours), aesthetics (fifteen hours), and, to complete the circle with which the instruction began, a thirty-hour course in the evidences of Christianity. All this, certainly no insignificant amount, is required work. There is one elective of thirty-two hours in the history of modern philosophy.

Crossing the Connecticut River, and coming to the University of Vermont, we find the following courses: psychology (Sully), logic (Davis's 'Theory of thought'), ethics (Calderwood), a short course in aesthetics, another short one in the evidences of religion, and quite an extensive course in metaphysics, in which Watson's 'Kant's philosophy in extracts,' and the exposition of Kant by Professor Morris, are used. At Williams, as in the University of Vermont, all philosophical work seems to be required, the curriculum including the following subjects: anthropology (Hopkins's 'Outline study of man'), logic, theology (dogmatic, apparently), natural theology (through the medium of Flint's 'Theism,' and Butler's 'Analogy'), ethics, and the history of philosophy. At Brown we find logic, three hours a week; intellectual philosophy, four hours, including studies in Hamilton, Kant, Porter, Sully; ethics, five hours, including Wayland, Calderwood, Kant, etc. There is also a course in natural theology. In addition to these required courses, there is an elective in the history of philosophy.

None of these colleges, it will be observed, is now a professedly denominational college. It may be well, accordingly, to add one which is: viz., Trinity. Here the required work is ethics (through the medium of Wayland), Butler's 'Analogy' and his sermons, metaphysics (Sir W. Hamilton), and courses in psychology and logic. Elective courses are those in anthropology (Hopkins): ethics, two courses, — one in Haven, and the other in Whewell and Plutarch, and metaphysics (McCosh). No very great differentiation is observable in these courses, although there is more ethics, and more ethics from a theological stand-point, in Trinity than in other colleges.

We turn now to the other end of the scale of evolution, where the courses are almost wholly lecture courses, and are, either entirely or in the major part, elective; and in which, also, the instruction is mainly from the historical side. Of such institutions, Harvard and the University of Michigan are instances, perhaps the only ones. In the latter college, the only required study in this line is a course in either psychology (Murray) or logic (Jevons). Elective courses are, two in psychology, one in experimental and another in its relations to philosophic problems. The course in the history of philosophy is three hours a week through the year. This is supplemented by a three-hour course in the principles of philosophy, followed by a study of Hegel's 'Logic.' The courses under the general head of ethics would include a course in ethics, historical and theoretical; one in the philosophy of state and history; and a course each

in Plato's 'Republic' and Aristotle's 'Ethics,' occupying together two hours per week through the year. Other courses are, one in Spencer's 'First principles,' and one each in aesthetics and Kant's 'Critique of pure reason,' the latter two being omitted this year.

The Harvard courses include in the history of philosophy, English philosophy, from Locke to Hume; French, from Descartes to Leibnitz; and German, from Kant to Hegel; and one each in German philosophy of the present day and Hegel's 'Phaenomenologie,' which are omitted the present year. Psychology and logic (Bain and Jevons) are covered in one course; there is also an advanced course in experimental psychology. There is a course in the philosophy of nature, discussing Spinoza and Spencer. There are also five courses in ethics and philosophy of religion, comprehending one on philosophy in relation to ethics and religion (Royce's 'Religious aspects of philosophy'); one on philosophy of religion; another on philosophic theism; one on historical ethics, including especially, it appears, Mill and Kant; and one on practical ethics of modern society. The account would be incomplete if we failed to notice Professor Goodwin's courses in Plato's 'Republic,' and in the history of philosophy before Aristotle, with Professor Greenough's course on later Greek philosophy. All of these courses are elective. It will be noticed that there are about the same number of courses given in both the two last-mentioned universities, but the courses appear to cover more hours per year at Harvard than at Michigan.

Intermediate between the two classes of colleges discussed, come, in the east, Yale and Princeton; in the west, the universities of Wisconsin and California. At Princeton there are required courses in psychology, logic, ethics, and Christian evidences; elective courses in physiological psychology, metaphysics, history of philosophy, and science of religion; and graduate courses in Plato's 'Philosophy,' and one hour per week of discussion of philosophic problems. At Yale almost the only required studies in the senior year are the philosophic courses. The required studies are as follows: logic, psychology, ethics, natural theology, and evidences of Christianity; the electives are, the history of philosophy, two hours through the year; a course in Locke and Berkeley for two hours first half-year, followed by 'special topics' the second half; and a two-hour course in physiological psychology through the year.

The list of colleges given might be considerably increased; but it suffices, I think, to justify the division of colleges, so far as their philosophic teaching is concerned, into three classes, of which the first would include by far the greater number of institutions. Did space permit, it would be interesting to give the courses in two or three of the best Canadian colleges. The practice there is to divide the subjects into 'pass' and 'honor' subjects; the former being psychology, logic, and ethics, and the latter including quite a wide range. At McGill, for instance, besides courses in the history of ancient and modern philosophy, the student must pass an examination on twelve masterpieces; for example, Aristotle's 'Ethics,' Descartes' 'Method and meditations,' Spinoza's 'Ethics,' Fraser's 'Berkeley,' Spencer's 'First principles,' etc. At University college, Toronto, this honor-work requires such solid reading as Green's 'Introduction to Hume,' and his 'Prolegomena to ethics.'

For the most part, these courses speak for themselves to one familiar with the courses in German universities, or even in Great Britain in the present renaissance of philosophy there. The greatest lack is undoubtedly in the department of the philosophy of nature. The philosophic interpretation and criticism of the principles of modern science seem to be unknown save at Harvard and the University of Michigan. The greatest advance which any one familiar with the philosophic announcements of the last eight or ten years will notice is the growing tendency to introduce the history of philosophy, and especially the study of the originals, particularly in Plato, Aristotle, Kant, and even Hegel. A striking and welcome phenomenon is the increasing disuse of Sir William Hamilton. I do not say this with especial reference to his philosophy, but because it is safe to say that the sole ideas which the vast majority of graduates of our colleges have of continental philosophy, have come, directly or indirectly, through Hamilton and Cousin; and it is difficult to say which is the more misleading as an authority in historic philosophy. Princeton presents one innovation, whence, I think, almost all of our colleges could learn something. It has called in men from its biological department to discuss physiological psychology. The discussion of the one subject of visual sensation and perception could easily be made remarkably fruitful for psychology, as well as leading up to the subject of space-perception in general, and the question of empiricism and intuitionalism, and the function of evolution in psychical life. It is no discredit to our teachers of philosophy to say that it is almost impossible that they should have special knowledge in physiological psychology. The instructor of to-day has now, in the subject of logic, psychology, ethics, the history of philosophy, and what is vaguely called 'metaphysics,' to cover a wider field than the

teacher of any other branch ; and restriction of subjects rather than their enlargement is the need.

It is impossible to discuss the subject of the future of philosophy-teaching in this country without reference to the mooted question of 'electives.' It is evident that the great majority of those American colleges that have not introduced the elective system are giving all the time to philosophic studies possible, though I do not undertake to say whether or not that time be distributed in the wisest way. In fact, the outside scoffer would probably say that relatively too much time is given them, when all studies are required. It will be noticed that the colleges where least philosophy is required are the ones where most is taught, and the ground is most widely covered. Personally, I should not be surprised to know that they are the ones where most vital interest is taken in these studies, save in the instances, happily many, of the smaller colleges, where the philosophic teaching is in the hands of a man of such strong character that the teaching is a lasting power for life in an ethical way, whatever may be said of the strictly technical value of the philosophy taught. JOHN DEWEY.

INSECTIVOROUS PLANTS.

THE peculiar insect-capturing habits of certain of our native plants were observed nearly a century ago, and the belief was then entertained that the peculiar phenomena served some direct object in the plants' economy ; in other words, that the captured insects served as nutritive material. These observations, however, were long forgotten, or received but little attention, till, in 1875, Darwin's well-known work on insectivorous plants appeared. Since then a very great impetus has been received by botanists in their study, that has resulted in large additions to the literature of the subject. In a recent paper by the well-known botanist of Jena, Prof. W. Detmers (*Nord und süd*, 1886, 72, 81), a review of our present knowledge is given, from which the following is obtained.

At present it is well known that the function of the green tissue is the absorption of carbonic acid from the surrounding medium under the influence of light, and its decomposition and formation therefrom of organic compounds. Most of the higher plants are capable of complete and perfect development solely by the aid of purely inorganic materials, though in the larger number organic matter may and does form a share of the nutritive material. In the economy of nature this function is a most important one, as plants thus occupy an intermediate position between the animal and inorganic kingdoms.

But some plants are not thus provided with the green or chlorophyl tissue, and are dependent more or less upon organic foods. In some, as the mildews, the power of transforming inorganic to organic substances is wholly wanting ; while in others, as, for instance, certain orchids, such as Neottia nidus avus, the power is much restricted. Likewise the mistletoe, though sufficiently rich in chlorophyl, derives much of its material from the sap of trees upon which it is parasitic. Insectivorous plants, in the same way, seem to occupy an intermediate position between those dependent entirely upon inorganic and those which derive their material purely from organic sources.

The term 'insectivorous,' as applied to plants, is, however, not strictly correct, nor would 'carnivorous' be much better. Different forms of animal life are captured by such plants as have received this appellation, and by the aid of secreted juices are digested and absorbed ; but there is no mechanical action except in capturing and holding the objects, and therefore 'flesh-digesting' would express more correctly the process.

One of the best known of insectivorous plants is the 'sundew' plant (Drosera), species of which are distributed over nearly the whole world. It is small and low, growing about meadowy places, and conspicuous for the sparkling drops of fluid substance that are seen upon its leaves. The leaves, which are about four millimetres in diameter, have upon their upper surface a large number of peculiar tentacle-like organs, as many as two hundred in some cases. The ones in the middle are shorter and upright ; those near the sides, longer and more horizontal. Each tentacle consists of a stem, permeated by a spiral tube, and a glandular head, which emits a drop of colorless, sticky, and stringy fluid. This substance apparently serves to attract insects as well as to retain them when once they have alighted upon the leaf, as it is seldom that they are able to extricate themselves after coming in contact with it. To yet further assure this retention, the leaves possess the power of closing or folding together, brought about slowly by the irritation conveyed through the tentacles. An insect thus firmly enclosed remains till the fluids secreted by the tentacular glands have caused its solution, or, more properly, digestion. Any foreign object, be it mineral or animal, will cause the closure of the leaf and the secretion of fluids ; but there is this remarkable difference, — a mineral substance only produces the flow of an acid secretion, while an insect or piece of flesh causes, in addition, a

secretion of pepsin. The process is almost precisely like that which occurs in the animal stomach, — a secretion of acids and ferment produced by the contact of digestible substances. The ferment or pepsin is not, however, a peculiarity of such plants alone. The milky sap of many others contains the same substance, and almost generally throughout the vegetable kingdom a ferment is produced in seeds during germination, rendering the reserve material, upon which the young plant is dependent, assimilable.

Yet better known is another plant of the same family (Droseraceae), the venus fly-trap (Dionaea), that grows in the wet lands of North Carolina. The leaves, about six centimetres in length, springing from the ground, have an elongated, winged stalk, bearing an orbicular leaf at its extremity, which is capable of sudden folding or closure. Along the margin of each leaf are a number of long, immovable, bristly hairs; and near the middle of each side, on the upper surface, three slender irritable hairs, which have the peculiar power, when touched, of conveying the irritation to the leaf-tissue, and causing immediate closure, the marginal bristles crossing each other, and preventing any possibility of escape. In addition to these hairs, there are a large number of glandular bodies attached by a short stem, which not only secrete the digestive fluids, but also serve as absorptive organs for the digested material. An insect or any digestible substance caught by this singular contrivance remains enclosed a relatively long time, while an inorganic or non-digestible object is much sooner released.

In a very different way the leaves of species of the pitcher-plant (Nepenthes) serve to entrap insects. Here the long leaf is prolonged into a tendril, which bears at its apex a tubular or oblong pitcher, sometimes a foot or more in length, closed with a hinged lid. About its rim there are a number of nectar-secreting glands, by which insects, and especially ants, are attracted. Entering easily into the upper part of the tube, they fall from the smooth surface to the bottom. Here there is a very large number of secreting glands, which, singularly, only in consequence of the irritation produced by the insects, pour out a considerable quantity of digestive fluid. This secretion shows, in the presence of albumen and flesh, a strong acid reaction, which, together with the associated pepsin, acts energetically upon animal substances, digesting them in a short time.

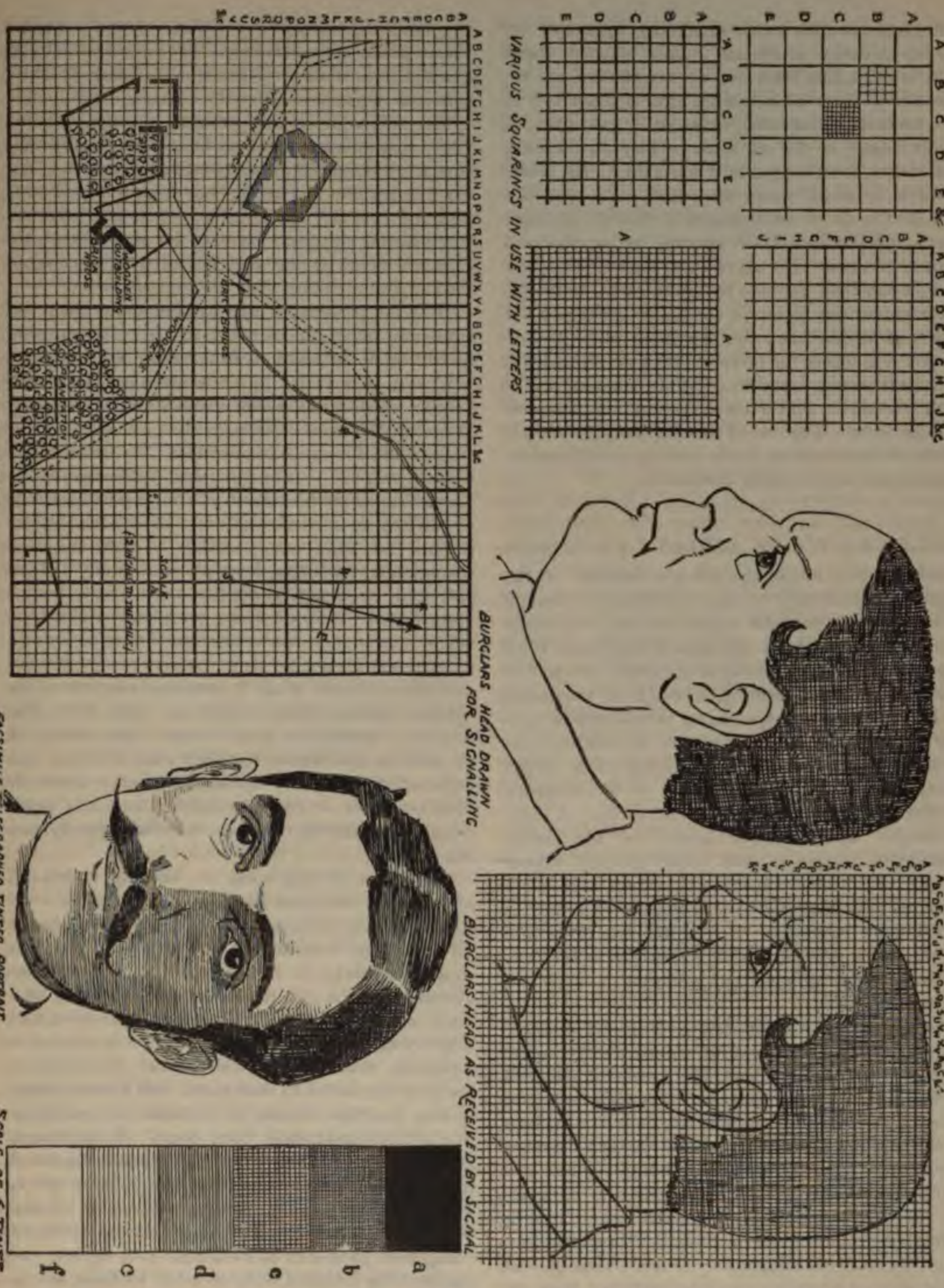
Again, species of our native Saracenia have the ascending hollow leaves so enclosed by a lid as to prevent the entrance of rain-water, but, by the nectar glands, attract and entrap insects, which are digested by the abundant secretion at the bottom. In addition to these, the aquatic bladderworts, or Utricularia of Europe and North America, although secreting no digestive fluid, may properly be classed among the insectivorous plants. The small bladders are so closed by a valve as to admit the ingress of insects, crustaceans, or newly hatched fish, but prevent their egress; and, from the large number that they are frequently found to contain, it is very probable that the ensuing decomposition is of direct advantage to the plant in furnishing nutritive, absorbable compounds.

The question, finally, whether organic material obtained and dissolved by the plant in the ways briefly described is indispensable or serviceable as nutrition, is important. Various carnivorous plants have been cultivated, secluded for a long time from all contact with organic material, without apparent deterioration in their development, so that it may at once be determined that such matter is not indispensable. However, in experiments with plants of Drosera rotundifolia, all kept under precisely the same circumstances, except that some were deprived entirely of organic food-material, while others received insects from time to time, it was found that the latter throve much better, and fructified much more abundantly.

These views, that the substances are of direct benefit to the plant, are, however, contested by Dr. Behr in a late number of the *Pharmaceutische rundschau*, who claims that it is not proved that the dissolved material is taken up as nutritive material, and so made use of. Its presence within the cells, or in the tissue of the plants, may be explained by simple capillarity, which is further evidenced by the absorption of inorganic substances, such as arsenious acid, by means of the secretions, as has been recently shown by Jaeger.

This opinion Dr. Behr supports by observations on species of Nepenthes, where he found that the pitchers, after the reception and solution of insects, were in no wise strengthened, but became injured and withered; and in cases of Drosera sulfurea and rosulata, where he likewise found that the leaves which had captured an insect always withered, and where many leaves were thus robbed of their true function, the plant weakened and died. He mentions the singular fact that the larvae of certain insects (Xanthoptera semicocca) are known to live in the exudations of Saracenia variolaris without being affected by the digestive fluids, — habits very similar to the known ones of bot-flies in the animal stomach.

It is very difficult indeed to understand how such remarkable contrivances, in connection with true digestive fluids, can exist, save on the theory that their function is a real one, and that they



subserve some direct use in plant-economy, and are not, as Dr. Behr would affirm, acquired peculiarities directly injurious to the organism.

A METHOD OF SIGNALLING DIAGRAMS.

AN ingenious system of adapting the alphabetical messages of the electric telegraph, or of the

heliograph, or any other signalling apparatus, to the reproduction at distant points of some kinds of drawings, has been recently contrived by Mr. Alexander Glen of England, and is described in the London *Illustrated news* of March 20. It seems likely to be of some utility in military operations, as it is especially suitable for the transmission of small maps or plans of a locality. The design to be transmitted is drawn on ruled paper, divided into little squares by vertical and horizontal lines. The operator at the transmitting-station can thus indicate by alphabetical letters to the receiver any point on the paper falling in the centre of any square; the person at the receiving-station will apply his pencil to that point, and will then be directed to the next point, drawing a line with the pencil, and so on to form a complete outline-drawing. Patches of shading, of the several darker or lighter tints shown in a separate diagram, may be put in by special directions.

BIBLIOGRAPHY OF INDIAN LANGUAGES.

MANY years since, the present director of the bureau of ethnology became interested in Indian tribes of the west, and began to study their languages. The study of the spoken language from the mouths of the speakers naturally led to the study of books containing accounts of languages no longer spoken, or spoken by people not personally visited. As books began to be studied, the desire and the need of examining more books relating to the subject were felt to be necessary for the solution of the problems involved. A card-catalogue was therefore begun, of the books, pamphlets, magazine and other articles, manuscripts, etc., which were needful for an exhaustive study of the relationships of the native tribes as based upon language. This catalogue grew and grew. How great it was or is destined to become, if absolutely completed and perfected, no one yet knows.

Every lover of systematic, complete, and accurate work owes a debt of thankfulness to the bureau of ethnology and the compiler of this formidable volume; and he owes this debt, not because the work is complete (for it is still incomplete), and not because it is free from inaccuracies (for there are inaccuracies, though these are neither important nor numerous), but he is grateful for this monument of systematic, thorough-going research, and for a persistent devotion to a lofty ideal of bibliographic work. Had a less lofty ideal of completeness or excellence been set up, the book would have been beyond all criticism. The very excellence of the ideal affords ground, and the only ground, for the friendly criticism we beg to offer.

Proof-sheets of a bibliography of the languages of the North American Indians. By JAMES CONSTANTINE PILLING. Washington, *Government*, 1885. 1175 p. 4°.

The titlepage of this printed but unpublished book is, and is intended to be, a standing invitation to criticism from all competent judges. We say printed but not published, since a manuscript note informs us, 'one hundred copies printed,' and the printed titlepage informs us that these one hundred volumes are 'distributed only to collaborators,' and also that they are 'proof-sheets.'

It is the fulness of the present catalogue, the time and labor spent upon it, the bibliographic spirit which pervades it, taken together with the titlepage, that bring into the strongest relief the perfect ideal in the author's mind, and at the same time his clear perception of the mode, and the only mode, for the attainment of this ideal. The author has set before him, and kept steadily in view, the purpose, first, of hunting up every scrap of published, printed, and even manuscript information in existence, relating to the subject; second, of recording a description of each work so full and so complete that it need never be recorded more fully or more completely; third, of telling where each work catalogued may be found; fourth, of giving a clear notion of what the document is, and what it contains relative to his subject, telling where, within the work cited, the linguistic material is to be found; and, lastly, of so putting the whole together that whoever has occasion to use this bibliography may learn all that he needs or cares to know about any book catalogued, and its contents, without actually seeing it at all.

The value of any work so broadly conceived and so fully executed as this, can hardly be overstated. With the great increase of knowledge in all directions, it is absolutely essential to progress that the fields to be investigated be first systematically mapped out, to the end that seeming new discoveries may be new, and not rediscoveries, and that energy be not, through ignorance, wasted in repeating work already well done. The sciences are now advanced to that state, that further satisfactory progress is only to be made by ascertaining what has already been done. To this end, and to so exhibit the work already accomplished in any line, is the work of the bibliographer. The general outline of the proposed plan of the bibliography is here shown, and the opinions of competent judges as to its merits and defects are respectfully solicited with a view to their use in the finished book or books, if books should be found necessary to contain the material which shall constitute the work.

Preceding the general alphabetical authors' list of books, which constitutes the great bulk of the book, is a list of the bibliographical authorities consulted, this list numbering a hundred and twelve entries, covering twenty-six pages. This list, being one subordinate to the general purpose for which the book is to be used, might go in a subordinate or smaller type, thus saving in two ways; to wit, in the space occupied, and in showing by the type itself that the list was subordinate to the main body of the work. In the very full index at the close of the book, and which constitutes the subject-catalogue, this plan is followed with good effect, and a complete subject-catalogue of Indian linguistics is thus printed on forty-five closely printed pages.

The serial numbers which accompany each title, and which are printed on the left, would interfere less with the catch-word of the title if transferred to the right; and the catch-word, the author's name, might then advantageously be brought to the left, a little beyond the line of the text. These detailed matters of printing here introduced and commented upon, though in general uncalled for, are pertinent to the present notice, since these are proof-sheets, and hence the finally adopted form is presumably not yet settled. Moreover, these questions admit of a more intelligent and satisfactory settlement from the existence in print of this material, which might, perchance, be denominated "Proof-sheets of material collected with a view of constructing an exhaustive bibliography of the languages of the native races of North America." This would seem to be a tolerably precise characterization of both the book and the author's conception of it. The term 'Indian' on the titlepage is of course used to include all native races, Eskimo, Aztecs, etc. Whether the word should be so used, is a matter for the ethnographer rather than the bibliographer.

The size of the work, and the fact that while going through the press two hundred and fifty pages of additions and corrections accumulated, show the importance of considering whether finally it will not be better to break this bibliography up into several subdivisions, so that, instead of having a very large bibliography of North American linguistics, we may have a more useful work, consisting of several parts, each devoted to a special group of languages, such as Algonkin, Eskimo, etc. All bibliographies should provide for growth. In any very comprehensive one, the first part begins to be antiquated before the last part is reached. Moreover, bibliographies, if of comparatively small subjects, can be revised, and kept up to date; but it is a formidable undertaking to revise, enlarge, and bring up to date, a work so large as this.

As the present tendency is pronouncedly in the direction of full bibliographies of small subjects, the most important question to be considered in the publication of this work would seem to be as to whether it should be one single bibliography of a very large subject, or a series of bibliographies of a number of small subjects.

Would it be better to prepare a bibliography of mathematics, or a series of bibliographies, on the different subdivisions of mathematics? And in meteorology will the signal service best serve the meteorological public by issuing one grand bibliography of meteorology, covering the entire field, or by subdividing into various heads, such as 'observations,' 'instruments,' 'theories,' etc., and issuing smaller bibliographies, covering the more limited fields? It is not our purpose to discuss these questions, but, rather, to sharply draw attention to them for the purpose of having them well considered before a final form is adopted.

The author is, in our opinion, to be congratulated upon selecting the form of an authors' catalogue rather than the subject-catalogue. The authors' catalogue admits practically of but a single arrangement, — the alphabetic, — since in any large list the chronological order proves of far less general utility.

The subject-catalogue, however, admits of several arrangements: it is always subject to radical changes based upon increased knowledge or new and revised systems of classification; and, lastly, to use a subject-catalogue, the system of classification used in that particular catalogue must be studied. It therefore seems far wiser, as Mr. Pilling has done, to make the index serve as the subject-catalogue.

DISEASES OF THE FORE-BRAIN.

THE scope of this work is indicated in its title. It is an attempt to explain both the nature of mental action and the perversions of that action from the data of the anatomist and the pathologist. Professor Meynert has no superior in Europe in the department in which he has written. To him anatomists owe much that is new and important in the knowledge of the structure of the brain. It is to be expected, therefore, that the results of his life-work should be regarded with great interest. In a comparatively small

Psychiatry: a clinical treatise on diseases of the fore-brain, based upon a study of its structure, functions, and nutrition. Part 1. By THEODOR MEYNERT, M.D. Tr. by B. Sachs, M.D. New York, *Putnam*, 1885. 8°.

compass he has given an exhaustive description of the masses of gray matter and intricate network of white fibres of which the brain consists; and he has done this from the stand-point of a comparative anatomist, which greatly enhances the values of his statements. There is such rapid progress being made in the department of nervous diseases, that it is perhaps not surprising that a few of the positions held by the author will need to be modified in the second volume: in fact, he admits this in his preface. But the great mass of the facts stated in the text are fixed and definite, and must be familiar to all future investigators in this field.

To the general reader the physiological portion of the volume will be much more attractive than its anatomical details. Here, again, Meynert is worthy of attention. It is pretty generally admitted that the method of introspection so long advocated by psychologists is incapable of giving satisfactory results in the investigation of those processes in which mind and matter meet: hence of late years new methods have been sought. One of these is to study the mental processes as they develop in the infant, and to watch the manner in which ideas are acquired and voluntary powers become available. This method has been employed by Preyer and Kussmaul in Germany, and by Dr. Mary Putnam Jacobi in this country. Meynert has made use of it to some extent in discussing the manner in which knowledge is acquired and stored up, and in which the various memories gained through the senses are associated. For example: if a pin touches the eye of an infant, the lid closes. This is a reflex act carried out by a simple mechanism independent of any act of consciousness; but, coincident with the reflex act, a number of impulses are sent to the brain, along fibres which, on reaching the cortex, give rise to the conscious perception of the appearance of the pin, of the pain of the prick, and of the motion which has been performed. Each of these perceptions occurs in a different part of the brain, since each sensory organ is joined to an area of its own. But the three perceptions occur simultaneously; and, as all parts of the cortex are joined with one another by fibres passing from one area to the next, the three perceptions are associated both in perception and in memory: hence, when the pin is seen again, the memory of the pain arises, and the memory of the motion which stopped the pain; and thus the mere sight of the pin leads the child to close the eye. The perception of the reflex motion has given the infant the knowledge of the possession of a muscle capable of movement; and the motion, having once become conscious, can be reproduced voluntarily by an effort which excites to action those cells which retain the memory of the motion (pp. 156–161).

A second method of psychological investigation is that of experimental physiology. This is open to the objection that many acts of animals are misinterpreted by physiologists, who look at many of the acts as manifestations of voluntary mental action instead of being instinctive. The differences of those who advocate or oppose the localization of functions as deduced from experiments are to be traced rather to their varying interpretations of the result of the experiments than to those results themselves. Meynert is a believer in the localization of functions, as is every physician who has seen much of brain-diseases, and he presents clearly the arguments in its favor derived from the investigations of Fritsch and Hitzig and Munk. A third means of studying the relations of mind and matter is the consideration of individuals who present disturbances of mind associated with definite forms of destruction of brain-tissue. Meynert's opportunities for such study are very great, as he has at his disposal the immense number of patients collected in the Vienna hospital. That he has made good use of his material is evident in the sections of this work which treat of the functions and nutrition of the brain. In the next volume this part of the work will be fully expanded. By means of these three methods much that is new and entertaining has been found in the physiology of thought, and much that is important both to the alienist and to the psychologist is brought forward. The book, therefore, appeals to a rather wider circle of readers than its title would indicate.

Those who have read the original will sympathize with the translator in the difficulties of his work. It is a misfortune of the author that he is at points exceedingly abstruse and even obscure; and this fact, as well as the very technical style of the original, has rendered the task undertaken a serious one. It has been done in a painstaking manner, the original being followed as closely as possible, without, at the same time, taking from the English its own construction and idiom. The translation has been made with the consent of the author and by one of his pupils. It is evident that he has labored hard, although in some places the meaning is difficult to grasp. This difficulty is to be traced to the original, as can be determined by a comparison of the two, and hence must not be laid at the door of the translator. The manner in which the publishers have presented the volumes is to be commended, no expense having been spared in reproducing the many valuable diagrams and illustrations of the original.

M. A. S.

SCIENCE.

FRIDAY, APRIL 23, 1886.

COMMENT AND CRITICISM.

AT A TIME when the interest in the industrial organization of society is so great as it is at the present moment, it seems proper that *Science* should do its part in giving an opportunity for the free discussion of the views of any who have made especial study of social questions. It is claimed by the leaders of the working-classes, so called, that the real advances in society organization are not led by the *doctrinaires* of the schools, but by hard-fisted workingmen, who know more of their physical and intellectual wants than they do of logic. These self-asserting leaders compliment the professors upon their well-rounded sentences, giving a history of what has been accomplished, and sketching what may be the outcome of the future, but they look upon the schoolmen as little more than scribes. Despite this lowly position to which the professors of political science are assigned, there can be no doubt of the necessity of giving the reading-classes as good an opportunity as possible for appreciating the present condition of social science and for understanding the questions which are now demanding solution. Before venturing upon the wide field of sociology, it is well first to present a clear statement of the tenets of political economy as they are advanced by the writers of the times. There exists in this country, as well as abroad, a body of students, principally young men, who, after pointing out the continued progress in the tenets of political science as time changes society, insist that the at present, or recently, held dogmas are not dogmas at all, but must yield to other rules of expediency involved by the changing condition of industrial activity.

Of course, it is well understood that one main difference between this new school and the old is in asserting the desirability of greater interference in industry on the part of the state. Somebody might say that this idea has come from Germany, where the state initiative is so paramount in all enterprise ; but the adherents of the new school repudiate the assertion that their movement is a German movement, and claim that the discontent with the application of antiquated doctrines made itself felt in the valley of the Po, the heart of New England, and on the banks of the Thames. In a word, they say that the times are ripe for a decided renovation of the tenets of political economy ; and it is with a view of giving this school an opportunity of propounding the fundamental principles which they think should rule at the present time in that science, that a series of articles has been arranged to appear in *Science*. This series begins in the present number with one upon 'The change in the tenets of political economy with time,' by Mr. Edwin R. A. Seligman of Columbia college. Others will follow by Prof. E. J. James, on 'The state as a factor in economics;' by Prof. R. T. Ely, on 'Ethics and economics;' by Prof. H. C. Adams, on 'The idea of property as an economic category,' showing how this varies with our ideas of what is best suited to the times; by Prof. J. B. Clark, upon 'The limits of competition, natural and artificial;' by Prof. R. M. Smith, on 'The methods of investigation in economics;' and by Prof. Simon Patten, on 'The effect of the consumption of wealth on the economic condition of society.' The article in the present number, by Mr. Seligman, is intended to present a review of the history of the industrial organization up to the present time, and to indicate in what direction the further development may take place. The other articles of the series will probably be accompanied by criticism from the pens of those belonging to the so-called orthodox school.

SEVERAL VIOLENT TORNADOES in Minnesota and Iowa, on the afternoon of April 14, proved unusually destructive to life and property on account of finding towns in their way. The description of them in the associated press reports is exceedingly poor, by reason of the reporters' unsuccessful efforts to do rhetorical justice to the sad occasion; but it may be gathered that there was a number of separate tornadoes occurring at about the same time, and following the customary south-west to north-east path, though there is confusion in the statements with respect

to this last point, and that in the neighboring districts there was a violent thunder-storm with heavy rain and hail. On consulting the daily weather-maps for April 14 and 15, a well-marked 'area of low pressure' is found moving northeastward from Wyoming, over Dakota, into the Winnipeg district; a very abnormal turn of the isotherms shows how the winds on the southeastern side of this 'area' carried warm air far up the Mississippi valley, and brought about the strong contrasts of temperature and moisture that generate violent local storms. These tornadoes were therefore *normal*, or like the average of their class, in every respect — except, perhaps, in occurring farther north than is usual at this time of year.

In review of this, there seems to be ground for the desire so generally expressed that the signal service should give some warning of the probable occurrence of tornadoes, at least in such a way that the inhabitants of towns in the exposed districts may be on the lookout for the approach of the dreaded funnel-cloud. The reports state that in the open country there was little loss of life, as the storms came by day, and persons generally saw them in time to take refuge in the tornado-cellars with which nearly every farm in that region is provided. But in the towns, where persons remain more indoors, and where clouds near the horizon are not easily seen, tornadoes too commonly arrive unperceived till the roar of their winds tells that there is no time for escape; and here some early intimation of the impending danger should be given. The warnings based on the conditions shown in the morning weather-map might be announced as experimental for a season, so that a public trial of their value could be made. Towns at least could be reached by telegraph and telephone in all parts of the Mississippi valley by noon on the days of danger; and the saving of lives in some places would compensate for a good deal of needless anxiety caused by warning towns that escape destruction. There seems to be no way whatever of saving property that lies in the path of the storm.

ONE HAS ONLY to glance at a bibliography of astronomy during the present century to become impressed with the fact of two very marked impulses to investigation in that science, given by the discovery, first, of the planet Neptune in 1846, and, second, of the satellites of Mars in 1877. The latter has given rise no less to a series of popular and educational books and treatises on astronomy, in many languages, of which, it would seem, the end is not yet. These have had all degrees of worth, as their production has been participated in by authors of all degrees of information and capacity, from those who have the scantiest of reason for writing any thing whatever, to astronomers of the maturest experience, both as teachers and as investigators. The author of the work to which we call attention in a subsequent column is not unknown in our country. His early years as an astronomer were spent at Parsonstown, Ireland, in charge of the mammoth reflecting telescope of the Earl of Rosse, to which post he was appointed in 1865, at the age of twenty-five years. Dr. Ball became astronomer royal twelve years ago; and he has attained no little fame as a lecturer, having appeared before the leading learned institutions of Great Britain. Also in 1884 he lectured before our own Lowell institute, Boston, and in January last the honor of knighthood was conferred upon him.

In view of these facts, the developments in regard to his unacknowledged appropriation of the work of others assume the greater importance. In the *Nation* a fortnight or two ago, attention was directed to certain passages in 'The story of the heavens,' which Dr. Ball had borrowed bodily from Professor Newcomb's 'Popular astronomy,' with evidently no intention of ever making a proper return; while, in our present issue, it becomes apparent that he has paid a like compliment to Professor Young's admirable treatise on 'The sun.' Every one who reads it must thank Dr. Ball for a fascinating book, a very accurate one too, and he has made excellent use of his pilferings; but it seems as if he might have made a freer use of inverted commas, or confined himself, if we may borrow from Mr. Lowell, to 'pillaging the dictionary.' And this leads us further to an uncompromising denunciation of a reckless, extempore sort of book-making, too common nowadays, and which cannot be too strongly condemned. The publishers, in their struggle to meet the insatiate cry for something new, something that will sell because it is new, are as much to be blamed as authors; and the people even more, for creating a demand for these loosely woven fabrics. It is, however, a demand

which, soon or late, must cease; for, while many buy, few read, and they the close readers who make quick work of the loose author. If it is a necessary stage of our evolution, it may be hoped that the relay is not far removed.

GOVERNMENT SURVEYS.

The proper co-ordination and management of the different government surveys, in order to secure in the most economical manner the results for which they were created, has been and yet is the subject of considerable discussion, and of diverse views among those interested. The consolidation of the geological surveys has prevented much of the clashing that formerly inevitably resulted, and at different times the national academy has been called upon to propose plans for the relations that should exist between the different bureaus. The chief ones proposed, as the readers of *Science* are aware, are, 1°, that the secretary of the Smithsonian institution should be placed in control: 2°, that there should be a cabinet officer, a secretary of science and industry, who should be charged with all the different bureaus. Prof. W. P. Trowbridge, in the issue of the New York *Star* for April 13, urges the establishment of a permanent commission, which should be competent to understand the different works, and have sufficient time to examine them yearly in detail. As he further says, there can be no question but that, in the appropriation of money by congress for any purpose whatsoever, the objects and aims to be accomplished by such appropriation should be definitely and fully known; and funds for any public works of a continuous character should never be dependent upon personal urging by the heads of bureaus, and all this should be within the province of a central co-ordinating authority.

He believes that a properly organized permanent non-political commission, such as that known as the Regents of the Smithsonian institution or the Lighthouse board, and in which should be represented the executive heads of the bureaus, the legislative branch of the government, and the scientific men of the country, would be an efficient safeguard against misdirected expenditures, faulty schemes or projects, and the duplication of work by two or more bureaus. It is not at all certain that a cabinet officer, with his political tenure of office, would be sufficient to co-ordinate the different surveys, except in so far as he would serve as a fiscal administrator, and as a medium between the scientific bureaus and congress or the executive. Political considerations would make it improbable that such a head could always be found who should possess the varied scientific and other qualifications that would be required to determine the scope, the field of work and investigation, and the methods to be pursued for each branch of scientific work.

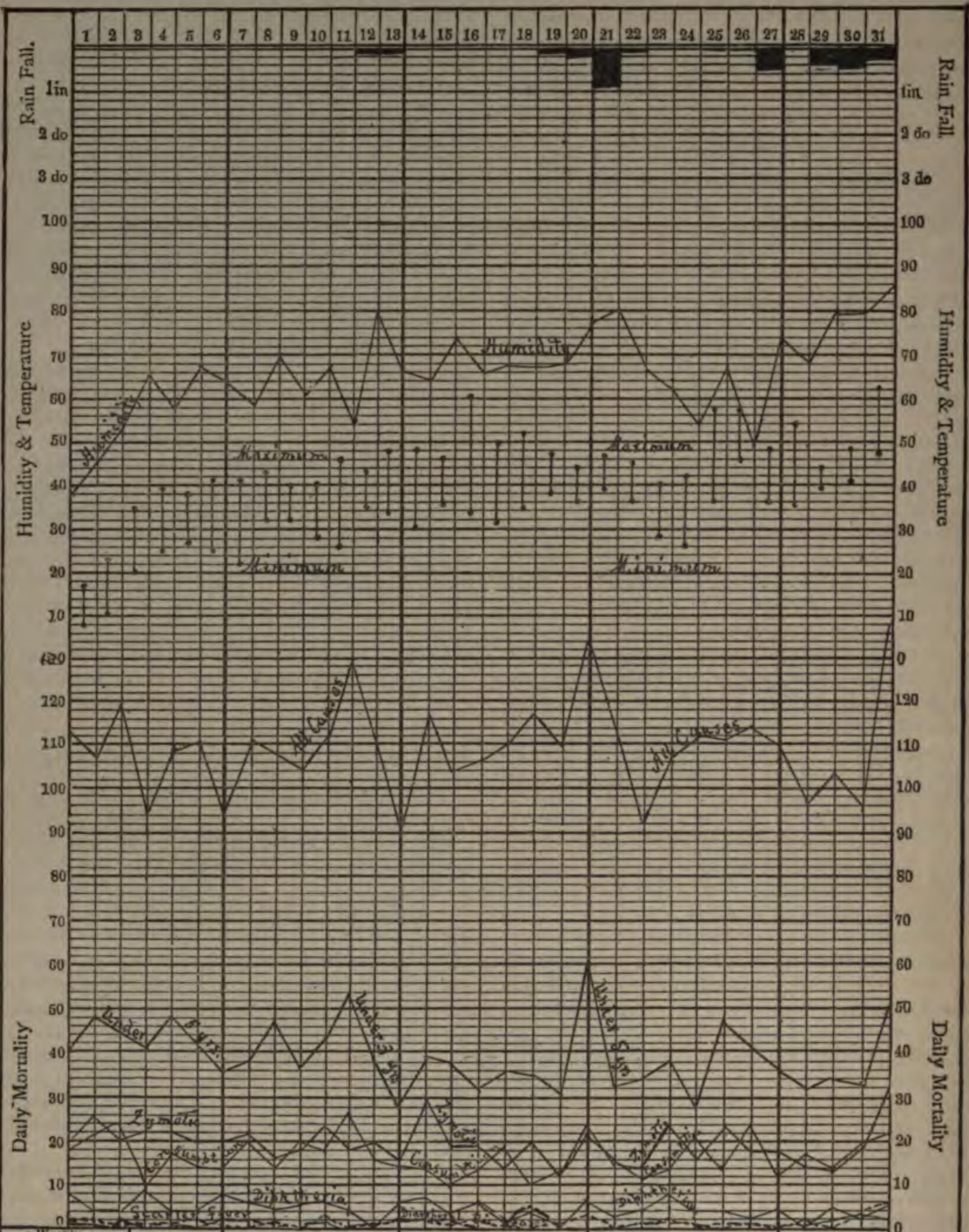
The executive and scientific details, as he rightly says, of any one of these bureaus, are enough to tax to the full extent of his powers the most skilled expert in those branches of scientific and practical knowledge which belong to the objects represented by the bureau. For this reason he deprecates any attempt to consolidate the different bureaus, and especially the coast and geodetic survey, whose work has been so fruitful of practical and valuable results for so many years, with any other.

The unfortunate shortcomings in this survey during the past year have given currency to numerous false and exaggerated rumors, which have tended to produce an injurious result, not only upon the public mind, but upon congress. Professor Trowbridge urges the injustice of including in general condemnation all the different bureaus on account of the errors of individuals in one branch, and yet more justly cites the long years of faithful and highly valuable public services that have been rendered by the great body of officers and attachés of the coast survey, who have grown up in the service, and who have not for a moment been included in any recent accusations.

HEALTH OF NEW YORK DURING MARCH.

We continue in the present number the graphic representation of the daily mortality in New York, which was commenced in *Science* in the number for March 19. In February the greatest mortality from all causes of disease was during the tenth day, when 118 persons died: during March this was exceeded on four days, running up to 137 on the last day of the month. During the twenty-eight days of February there were 2,767 deaths; during the same period in March there were 3,054 deaths, — an increase of 277: if to this are added the deaths which occurred in the last three days of March, we shall have 3,392 representing the mortality of the past month, — an average of nearly 110 each day, or about 5 persons every hour.

The number of deaths of children under five years of age has increased as compared with February; there has also been an increase in the zymotic class and in consumption; while the mortality from diphtheria and scarlet-fever is less. Diarrhoeal diseases have carried off 32 persons, as compared with 33 in the preceding month.



Weekly Mortality	746	763	796	758	
Weekly mean Thermometer	24.2	36.4	41.2	41.1	
Weekly mean Barometer	29.770	29.703	29.922	29.694	

The coincidence between the lines of scarlet-fever and diarrhoeal diseases, to which attention was directed in the number of *Science* already referred to, is equally marked this month: in fact, they run so nearly parallel, that it is often impossible to distinguish them. The summer mortality has not yet commenced to show itself, but many weeks will not pass before we shall see its line gradually rising higher and higher, until it reaches its height in midsummer.

The meteorology for the month presents some interesting features. The rainfall was considerably less than in February; in the latter month 4.89 inches having fallen, while during March there were 2.83 inches, the actual time in which this amount fell being 2 days 20 hours 40 minutes. During the sixteen years 1869–84 this amount was exceeded in every year but four, so that March, 1886, was, in comparison with other years, a dry month.

Another point of interest in the meteorology of March of this year is the absence of snow. But an inch fell during the entire month, and that on the twenty-seventh day. During the period of sixteen years already referred to, so small an amount fell in only five years, while in some of the years the quantity was very great; notably in 1870, when 9.63 inches fell; in 1875, 15.25 inches; and in 1883, 10 inches.

It will be remembered that in February the highest reading of the thermometer was 52° F., and the lowest — 4° F. In March the maximum temperature was 62° F., and the minimum 8° F., the monthly mean for March being some 31° higher than that for the preceding month.

The population of the city of New York on March 1 was estimated to be 1,424,903, and increases presumably 799 each week.

POPULAR ASTRONOMY.

IN the 'Story of the heavens,' Dr. Ball presents to the popular reader an extremely entertaining account of the discoveries, researches, facts, and theories, of a science which, in a general way, is of interest to a larger class of people than any other department of learning. The book is specially directed to the non-astronomical; the style is strong and vigorous; and many points are elucidated in so striking a manner that even the professional astronomer, if modest enough, can get many a good suggestion from it.

Ambiguities and misstatements of fact are quite entirely absent. Dr. Ball appears to be rather less certain than the facts warrant, that the sun-spots are depressions; and he would find few astronomers, in this country at least, who would agree with him that the late Professor Watson probably discovered an intra-mercurial planet or planets during the eclipse of 1878. In parts of his work the historical method is pushed to the extreme. The complex theories of our astronomy will doubtless appear in the least difficult form if viewed in the light of the logical order of their dawning upon the philosophic mind; but the attempt to insist on this method of treatment appears, in some instances, to have led Dr. Ball into an unnecessary multiplication of wordy paragraphs. While thoroughly interesting and delightfully told, his 'Story' is, for all that, a pretty long one; and we cannot but think that it would have been better received, not to say more carefully read, if, by some such omissions as these, Dr. Ball had sooner brought it to a close.

Works on popular science, often a mere retailing at second or third hand of the labors of the professional investigator, are not infrequently filled with such misrepresentations of these labors as to be utterly misleading to the learner, not to say wrath-inspiring to those scientists whose work forms the unwilling subject of the story. Dr. Ball commits no offence of this sort: he is one of these investigators himself, but his own researches are not brought into undue prominence. We should, however, take exception to his account of the transit of Venus of 1882 as seen at Dunsink, where no observations of marked importance could be made, — an account which, therefore, cannot give a sufficient and characteristic view of the magnitude of the very extended operations conducted elsewhere on that occasion. We find no allusion to the abundant series of photographs of that transit, obtained by the American parties, which, it is safe to say, constitute the most important and successful record of a transit of Venus ever secured.

In some other parts, also, the 'Story of the heavens' is not well balanced. There is, perchance, the best of reason for being dissatisfied, or rather unsatisfied, with the present state of solar research. In the chapter on the sun, we find an exceptionally full description of the solar spots; but the question as to what they are is dismissed in a word. The progressive theories of the constitution of these objects form a most important contribution to the history of astronomy; and many a page in the book might better have been devoted to an outlined statement of these theories, and of what the spots, to say the least, seem likely to be. We should make much the same criticism of the author's treatment of that

The story of the heavens. By ROBERT STAWELL BALL. London, *Cassell*, 1885. 8°.

important but mysterious phenomenon, the zodiacal light.

No inconsiderable number of persons sufficiently interested in astronomy to read a book of this sort desire to become themselves observers; not with reference to making contributions of value to the science, but simply for their own advancement and edification. Early in his work, Dr. Ball has an interesting word for such readers, suggesting work well worth doing, and for which only an opera-glass is required. Why not have elaborated this idea more fully farther on, and with reference to various celestial objects within ready reach of slender telescopic means?

We are glad to see the care with which an abounding index has been prepared: it contains something like twelve hundred entries, and covers no less than eleven pages of the book.

In the last chapter, when treating of the tides, Dr. Ball is at his best. And by tides are meant, not alone the rise and fall of the sea as we note it to-day, but the term is used in its broadest sense, and the vast problems of tidal evolution dealt with in a wholly captivating style. This new departure in mathematical astronomy, as Dr. Ball justly terms it, is fully elucidated, and the non-mathematical reader owes him many an obligation for this clear and elegant exposition of the profound mathematical researches of Professor Darwin.

The illustrations are, as a whole, the best we have seen in any book on popular astronomy. A good many of them are new, a good many are borrowed with full credit, and yet others are borrowed without any credit. To the last class belong a number appropriated from Newcomb's 'Popular astronomy,' notably those on pp. 78 and 214 of the latter work, which are reproduced on pp. 104 and 228 of Ball. Presumably the charge of plagiarizing the text accompanying these illustrations would be sustained with difficulty; but it would be interesting to know how much time elapsed between Dr. Ball's reading of this text, and the writing of his own paragraphs on the effect of gravity on a projectile, and on the toothed-wheel method of determining the velocity of light. In our way of looking at it, subtracting the smoke from the lamp, and five teeth from the wheel, and supplementing the man's head with one shoulder and a mustache, fail to establish one's right to an illustration otherwise successfully 'conveyed.'

But Dr. Ball has not confined his attentions to a single work. In filling out his chapter on the sun, he found that something already written by somebody else would save him the drudgery of a page here and there, and he appears to have had no compunction in calling it his own. A few paragraphs from Young's 'The sun' and from Ball's 'The story of the heavens' are subjoined: —

YOUNG (p. 118).

"The average life of a sun-spot may be taken as two or three months; the longest yet on record is that of a spot observed in 1840 and 1841, which lasted eighteen months. . . . While some spots are thus long-lived, others, however, endure only for a day or two, and sometimes only for a few hours.

"The spots usually appear not singly, but in groups — . . . Very often a large spot is followed upon the eastern side by a train of smaller ones; many of which, in such a case, are apt to be very imperfect in structure, . . . When a large spot divides into two or more, as often happens, the parts usually seem to repel each other, and fly asunder . . . velocities of one thousand miles, and even more, are by no means exceptional.

"At times, though very rarely, a different phenomenon of the most surprising and startling character appears in connection with these objects: patches of intense brightness suddenly break out, remaining visible for a few minutes, moving, while they last, with velocities as great as one hundred miles *a second*.

"One of these events has become classical. It occurred on the forenoon (Greenwich time) of Sept. 1, 1859, and was independently witnessed by two well-known and reliable observers, Mr. Carrington and Mr. Hodgson, . . . Mr. Carrington at the time was making his usual daily observation upon the position, configuration, and size of the spots by means of an image of the solar disk upon a screen, . . . Mr. Hodgson, at a distance of many miles, was at the same time sketching details of sun-spot structure . . . They simultaneously saw two luminous objects, shaped something like two new moons, each about eight thousand miles in length and two thousand wide, at a distance of some twelve thousand miles from each other. These burst suddenly into sight at the edge of a great sun-spot, with a

BALL (p. 36).

"The average duration of a sun-spot is about two or three months, and the longest life of a spot that has been recorded is one which in 1840 and 1841 lasted for eighteen months. There are, however, some spots which last only for a day or two, and some only for a few hours.

"It should also be observed that the sun spots usually appear in groups, and very often a large spot is attended or followed by a number of smaller ones, more or less imperfect. It often happens that a large spot divides into two or more smaller spots, and these parts have been sometimes seen to fly apart, with a velocity in some cases not less than a thousand miles an hour. On rare occasions a phenomenon of the most surprising character has been witnessed in connection with the sun-spots, where patches of intense brightness suddenly break out, remain visible for a few minutes, and travel with a velocity of over a hundred miles a second. One of these events has become celebrated for the extraordinary character of the phenomena, as well as for the fortunate circumstance that it has been authenticated by the independent testimony of the skilled witnesses. On the forenoon of the 1st September, 1859, two well-known observers of the sun, Mr. Carrington and Mr. Hodgson, were both engaged in observation. Mr. Carrington was employed at his self-imposed daily task of observing the positions, the configuration, and the size of the spots by means of an image of the sun upon a screen. Mr. Hodgson, many miles away, was at the same moment sketching some details of sun-spot structure. They saw simultaneously two luminous objects, shaped something like two new moons, each about eight thousand miles long and two thousand miles wide, at a distance of about twelve thousand miles

dazzling brightness at least five or six times that of the neighboring portions of the photosphere, and moved eastward over the spot in parallel lines, growing smaller and fainter, until in about five minutes they disappeared, after traversing a course of nearly thirty-six thousand miles."

apart: these suddenly burst into view near the edge of a great sun-spot, with a brightness at least five or six times that of the neighboring parts of the sun, and travelled eastward over the spot in parallel lines, growing smaller and fainter, until in about five minutes they disappeared, after a journey of about thirty-six thousand miles."

YOUNG (p. 267).

". . . the temperature at the focus can not rise above that of the source of heat, the effect of the lens being simply to move the object at the focus virtually toward the sun; so that, if we neglect the loss of heat by transmission through the glass, the temperature at the focus should be the same as that of a point placed at such a distance from the sun that the solar disk would seem just as large as the lens itself viewed from its own focus.

"The most powerful lens yet constructed thus virtually transports an object at its focus to within about two hundred and fifty thousand miles of the sun's surface, and in this focus the most refractory substances — platinum, fire-clay, the diamond itself — are either instantly melted or dissipated in vapor. There can be no doubt that, if the sun were to come as near us as the moon, the solid earth would melt like wax."

BALL (p. 495).

". . . the temperature at the focus cannot be greater, cannot be even equal, to the temperature at the source of heat itself. The effect of a burning-glass is merely equivalent to making a closer approach towards the sun. The rule is indeed a simple one. The temperature at the focus of the burning-glass is the same as that of a point placed at such a distance from the sun that the solar disk would seem just as large as the lens itself viewed from its own focus. The greatest burning-glass which has ever been constructed virtually transports an object at its focus to within 250,000 miles of the sun's surface: in other words, to a distance of about 1-400th part of its present amount. In this focus it was found that the most refractory substances, agate, cornelian, platinum, fire-clay, the diamond itself, were melted or even dissipated into vapour. There can be no doubt that if the sun were to come as near to us as the moon, the solid earth itself would melt like wax."

By what name Dr. Ball would call this wholesale pillaging of others' books, we do not know: but it seems to us to fall little short of tallying with the work of the plagiary. Substituting 'greatest burning-glass' for 'most powerful lens,' and adding agate and cornelian to a list of refractory substances already fully long enough for the purpose of illustration, do not show any mark of great originality, while the continued effort to conceal the theft is petty in the extreme. We have not had the time to trace Dr. Ball's possible liberties with other authors than these, but our researches thus far have left us in the mood for suggesting that the titlepage of subsequent editions of his work might with some little show of justice contain the insertion 'compiled by ——.' Any one who cares to investigate further may perhaps like to judge for himself how much of pp. 495–505 in Dr. Ball's very interesting chapter on the 'Astronomical significance of heat' (the greater part) was directly suggested by a like number of pages at the end of Professor Young's chapter on the 'Sun's light and heat.' While in another part of his book Dr. Ball alludes to Professor Young as 'the well-known authority,' etc., in the chapter in question we find no mention of the name. Professor Young would doubtless be very glad to be of assistance to Dr. Ball, but we think he is human enough to care for the graceful acknowledgment of the service.

GEOGRAPHICAL NOTES.

Dutch statistics of population. — Kuyper has recently given an interesting discussion of the population-statistics of the Netherlands. The population for the whole kingdom is found to be 121.6 per square kilometre, and 75.0 for the lowlands, and varies from 265.9 to 44.6 for the same area in different districts. The females out-number the males by from one to two per cent. Of the population, 32 per cent are married; 61.55 per cent are Protestants, 36.02 are Catholics, and 2.04 per cent are Israelites, in religion; and, in occupation, 20 per cent are agriculturalists, 26 per cent laborers, 12 per cent merchants, 18 per cent manufacturers or mechanics, 2.5 per cent soldiers, 2.3 per cent engaged in religious, scientific, or sanitary professions. The increase of population from 1860 to 1880 varied from 12 per cent, in Limburg, to 30 per cent, in Holland proper. Of thirty-eight centres of over 10,000 inhabitants, one (Delftshaven) has doubled, seventeen have increased more than 25 per cent, and twelve others have increased from 10 to 25 per cent, during the same period. The work is supplemented by an instructive chart showing the increase of population for the period by single parishes, — a course only practicable in so small a country as Holland.

Search for mammoths in the Lena Delta. — Dr. Bunge has sent to St. Petersburg a chart of the Lena Delta, corrected during the numerous long journeys undertaken by him in search of frozen mammoths. His travels were more lucky geographically than biologically, for he found but one skeleton, and that deprived of head and one fore-leg. It had been exposed for ten years to the attacks of dogs, foxes, and natives, but had originally been covered with a thick coat of hair, which might have defended it against even the present climate of the delta, provided it could have obtained food to its liking.

Medals of Paris geographical society. — The great gold medal of the Paris geographical so-

ciety, for 1886, has been awarded to Messrs. Capello and Ivens, for their African journeys. A smaller gold medal has been given to the 'Pundit A. K.,' one of the anonymous explorers for England of upper Tibet; and medals of silver and bronze to Messrs. Bloyet and H. Mager, for African topography and the 'Colonial atlas.' The *prix Logerot* is received by M. Marche, for his explorations of the Philippines.

A new oil. — The oil of a species of bamboo of African origin is reported by the Catholic missionaries of Alima in Africa to be an excellent lubricator, and, when refined, to form a fair substitute for olive-oil in the cuisine. The new industry thus created is actually in process of development in the French Kongo region.

Ethnographic map of Asia. —Von Haardt of Vienna has sent out a prospectus of a new ethnographic map of Asia, in six sheets, scale 1: 8,000,000, total size 175 x 140 cm. The scheme includes one hundred and thirty-six ethnic divisions, to be indicated by appropriate tints and hachuring. The subscription price is placed at thirty francs. The classification adopted has its defects; but the map, which will be accompanied by a small explanatory pamphlet, to all interested in the distribution of mankind, will have great value. If successful, it will be followed by maps of other continents, on the same plan. Subscriptions are to be sent to Eduard Hölzel, Vienna, Weyringergasse 19.

ASTRONOMICAL NOTES.

The two comets. — Fabry's comet continues to increase in brightness, and on a clear morning is bright enough to be made out with the naked eye, though it does not reach a sufficient altitude before sunrise to be very conspicuous in the presence of bright moonlight. Barnard described it on the 8th inst. as a hazy object with a faint tail, which, in the telescope, could be traced for five or six degrees. On April 24 the comet will be in the constellation Triangulum, in right ascension $1^h\ 32^m$, north declination 30° 3′, and will appear above the horizon about half-past three in the morning. Its brightness is then 297 times as great as at the time of discovery. The comet is increasing its right ascension, and is moving rapidly south: at the end of April, according to Dr. Oppenheim's ephemeris, it will approach us within a fifth part of the distance of the sun, and its theoretical brightness will be nearly 500 times that at discovery. Barnard's comet is also increasing in brightness, but somewhat more slowly than Fabry's. It makes its nearest approach to the sun in the first week of May, and its nearest to the earth in the latter part of that month. The position for the last of this week (April 24) is: right ascension, $1^h\ 40^m$; north declination, 39° 39′, with a calculated brightness of 62: it is nearly midway between the second magnitude stars β and γ Andromedae, and sets a little after eight o'clock. The astronomical positions we have given can readily be found upon the star-maps (map I.) given in the *Science* Almanac for last year (vol. iv. No. 99) or upon any celestial atlas.

The new nebula in the Pleiades. — The nebula discovered by the Henry brothers of the Paris observatory, upon their photographic negative of the Pleiades taken Nov. 16, 1885, has been seen — now that its existence is known — without great difficulty, by Perrotin and his assistants at Nice, and by Struve with his new 30-inch Clark objective, and also with the 15-inch at Pulkowa. Struve gives a careful description of the nebula, accompanied by a sketch, in the *Astronomische nachrichten* (No. 2,719), and from his observations it seems probable that some of the small stars in the immediate neighborhood may prove to be interesting variables. The nebula is of a characteristic spiral form, and seems to 'escape' from the star Maia. Professor Pickering, upon the announcement of the discovery, recalled the circumstance that certain irregularities had been noticed in a photograph of the Pleiades taken on Nov. 3, 1885, at Harvard college observatory. These irregularities, which had been referred to defects in the photographic process, correspond closely with the descriptions of the nebula, and no doubt represent light photographically visible near Maia. "The explanation thus afforded, of one of the markings on the Cambridge photograph, makes the others of more interest than seemed at first to belong to them. There are indications of nebulous light about Merope; four short parallel streaks directed to the south following side are particularly noticeable, and a faint prolongation of diffuse light may be suspected towards the south, in agreement with the descriptions usually given of the visible nebula in that region. There is also a faint streak of light projecting from Electra on the following side. . . . No nebulous light is noticeable about Alcyone, Atlas, Pleione, or Taygeta."

NOTES AND NEWS.

As stated in our 'Boston letter' of March 12, the liberality and co-operation of the Woman's education association enable the Boston society of natural history to announce that the Seaside laboratory at Annisquam, Mass., will be open to students during the coming summer from June 15 to Aug. 15, 1886. Annisquam is situated on an inlet of Ipswich Bay, on the north side of Cape Ann,

and is about three miles and a half by coach from the Eastern railroad station in Gloucester. The purpose of the laboratory is to afford opportunities for the study of the development, anatomy, and habits of common types of marine animals, under suitable direction and advice. There will be no attempt to give lectures or any stated courses of instruction. The laboratory has been in operation for four successive summers, and has fairly met the wants of a number of students, teachers, and investigators. Those who have had some experience in a laboratory, who have attended practical lessons, or who have taught in the schools, are sufficiently qualified to make use of this opportunity. The instruction and work of the laboratory will be under the immediate care of Mr. B. H. Van Vleck, assistant in the laboratory of the Boston society of natural history, a gentleman well known as a teacher, and who has also had long experience in collecting and observing at the seaside. Applications should be made immediately, and can be addressed to Mr. B. H. Van Vleck.

— The Boston *Transcript* states that Mr. Alfred Russell Wallace, the celebrated English naturalist, who shares with Darwin the honor of an independent discovery of the law of 'the survival of the fittest,' is coming to the United States on the invitation of Mr. Augustus Lowell of Boston, to deliver a course of eight lectures before the Lowell institute, in that city, beginning in October. It will be remembered that it was on a similar invitation (from Mr. Lowell's father) that Professor Agassiz first came to America, in the autumn of 1846. After completing his Lowell institute course, Mr. Wallace will lecture in other cities, and proposes to return to England in the spring of 1887. His subjects will be chosen from natural history.

— During the past week the occurrence of a large number of insects of a formidable appearance in Washington has attracted considerable attention. The following account of their habits and appearance is given by one of the entomologists of the agricultural department: This large insect of two inches and a half, or more, in length is the Belostoma americanum of entomologists, and belongs to the order Hemiptera, or true bugs. It lives in ponds and sluggish streams during the immature state, in which it has no wings, and is full grown in fall, remaining in the ponds during the winter. When, in the spring, the warm weather awakens them, they come forth at dark, often in immense numbers, and fly about: the sexes mate, and they return to the ponds in which the female deposits her eggs. They are strongly attracted by light, and especially by electric lamps, under which vast numbers often strew the walks, and are crushed under foot. Their sudden appearance often creates alarm; and during the past week or two, specimens have been received from various parts of North Carolina and other southern states, the writers often in evident fear of damage from this insect invasion. But they are perfectly harmless. They are, it is true, able to inflict a very painful bite, for they are provided with a short, sharp beak; but they never do so voluntarily, and they do not live on any thing in the way of vegetable matter outside of the water. They are carnivorous, feeding principally on less powerful water-insects, and not despising an occasional fish, frog, or other bit of flesh that may come in their way. They have been just as abundant in previous seasons, but have not been so much noticed, for the reason that there have not been so many electric lights to which they could be attracted. Like so many of the true bugs, they have a very peculiar and rank smell. A number of other water-insects are also attracted to light, but never in such quantities.

— The following papers were entered to be read at the annual meeting of the National academy of sciences, which convened at Washington, Tuesday, April 20: G. F. Gilbert, The geologic age of the Equus fauna; T. Sterry Hunt, The Cowles electrical furnace; E. D. Cope, On the phylogeny of the Batrachia; On the phylogeny of the placental mammalia; H. A. Newton, The comet of Biela; Elias Loomis, Areas of high barometric pressure over Europe and Asia; Samuel H. Scudder, The cockroach in the past and present; James D. Dana, Biographical memoir of Arnold Guyot.

— In his annual report for 1885, the United States entomologist continues his report on silk-culture in the United States. He does not speak very encouragingly of its immediate success as a profitable industry, and thinks any stimulus given to it must needs be temporary, and that the substantial way of encouraging the industry will be by imposing an import duty on the reeled silk from foreign countries. Two stations have been established by the agricultural department during the past year for the production of reeled silk; and Dr. Riley concludes, that, with the introduction of the improved Serrell reel, the cost of reeled silk per pound may be reduced to $4.38. The cost of several hundred pounds of reeled silk produced at the New Orleans station was $5.90 per pound, or, as corrected for needless expenditure, $5.35: it brought in the market $4.50.

— The meeting of the engineers' club of Philadelphia on April 3 was spent in an interchange of views as to how to best promote a more extended discussion of the numerous subjects brought before the club. Various methods of bringing original papers to the early attention of members likely to discuss them were proposed, and the subject was finally referred to a committee. This is a serious question with most of the scientific clubs of the country, which find their meetings generally of a stiff and formal character, tending to stifle all debate.

— The chemical laboratory of Fresenius at Wiesbaden enjoys a very large attendance, says the *Chemical news*. In the winter term, 1885–86, there were 90 students on the books. Of these, 58 were from Germany, 6 from Austro-Hungary, 6 from North America, 5 from England, 5 from Russia, 3 from France, 2 from Switzerland, 2 from Holland, 1 from Luxemburg, 1 from Sweden, and 1 from Norway. Besides the director, Geh. Hofrath Prof. Dr. R. Fresenius, there are engaged as teachers in the establishment Prof. Dr. H. Fresenius, Dr. E. Borgmann, Dr. W. Fresenius, Dr. E. Hintz, Dr. med. F. Hueppe, and Architect Brahm. The assistants in the instruction laboratory were two in number, in the private laboratory twelve, and in the versuchsstation three. During the last term, besides the scientific researches, a great number of analyses were undertaken in the different departments of the laboratory and the versuchsstation on behalf of manufacture, trade, mining, agriculture, and hygiene.

— The Woman's education association of Boston has made arrangements for a course of lessons in botany by Prof. George L. Goodale of Harvard university. The course is designed to present the principal laws of life and growth of plants, and will deal especially with methods for cultivating and collecting plants for study. Each lecture will occupy about half an hour, and, as in former years, will be followed by a practical exercise in the examination of plants. These laboratory exercises are arranged for beginners, but will also serve to supplement previous courses of botanical practice. The lectures will begin on Monday, March 22, and will be given on Fridays and Mondays in the rooms of the Natural history society. Tickets for the course, at ten dollars, may be obtained at the Natural history rooms.

— It is proposed to raise a fund by public subscription for the purpose of presenting a testimonial to the Rev. H. H. Higgins of England, in recognition of the services he has rendered to the cause of education, and especially to the various departments of science during the last forty-three years. Contributions may be sent to Baron L. Bevas, 1 Lord Str., Liverpool, Eng.

— The office of *secrétaire perpétuel* of the French academy, left vacant by the death of M. Jamin, has been filled by the election of M. Vulpian. The two principal candidates were M. Vulpian and M. Alphonse Milne Edwards, the former of whom received twenty-six, the latter twenty-four votes.

— It has long been known that petroleum existed in the vicinity of Jemsah, on the west coast of the Red Sea, about one hundred and seventy miles south of Suez; but previous explorations have produced no result. In September, 1884, a Belgian mining engineer, M. Debay, was sent to report on the possibilities of the practical working of the oil-beds, and, after much trouble, he has finally succeeded in reaching practical results. After penetrating successively through gypsum, containing veins and nests of sulphur, shale, green and blue clay, limestone, and sandstone, the drill, on Feb. 28, fell suddenly forty centimetres, and petroleum rose to a point two metres above the sea-level. On receipt of the news, Nubar Pasha arranged an expedition of experts, from whose examination there has resulted the establishment of the following facts: that petroleum undoubtedly exists; that the geological formation of the country is favorable to the existence of larger quantities at lower depths; that the store of oil is generally distributed over a large area in the neighborhood; that under existing unfavorable conditions a single source yields about two tons daily; that the specific gravity is .88; and that the spot is easily accessible from the coast, where there is good anchorage.

— The ravages of the phylloxera have, during the past year, extended into a number of cantons in Switzerland where the insect has never been hitherto observed, and have caused considerable uneasiness in the wine-producing industry. In connection with the continual extension of the fields of its devastation in foreign countries, it is of interest to note, that, in Professor Hilgard's last report of the viticultural work in California, it is stated that the habits of the insect in that state deviate from those observed in foreign countries to such an extent that the dangers of infection are much lessened. These differences in habits consist in the rarity of the winged female form, and the apparent absence of winter eggs, both probably due to the climatic influences. The mercurial vapor remedy, of which much has been hoped, has, in the hands of Professor Hilgard and his assistant Mr. F. W. Morse, failed to produce its promised results as a phylloxera insecticide.

— A new explosive has been invented by F. Redtenbacher, a mining engineer in Austria. It probably contains only the elements of ordinary powder, but in proportions determined by twenty odd years of research. This powder is brownish black in color. The advantages of the explosive, which is known as 'miline,' are its insensibility to percussion or friction, and that it can only be ignited by a spark. There exists, therefore, little danger in its transportation and preparation. It does not undergo any modification under the influence of temperature, and only ignites at 335° to 340° C. It burns with little smoke, and does not produce any deleterious gas. It can be employed exactly as powder, and, when well tamped, its effects are comparable with those of dynamite.

— Mr. A. Vogel has recently shown (*Centralblatt f. agric. chemie*) that cinchona-trees, growing in hot-houses in Europe, develop no quinine in their bark.

— King Oscar of Sweden has ordained two prize contests on oriental subjects, — one, the history of the Semitic languages; the other, a description of the Arabic civilization before the time of Mohammed. The prizes are a gold medal worth 1,000 Swedish crowns, and a sum of money equal to 1,250 Swedish crowns. The treatises may be written in Latin or German, and may be forwarded to Professor Fleischer of Leipzig, or Professor Nöldecke of Strassburg, before June 30, 1888.

— The investigation before the Massachusetts legislative committee on the subject of arsenic in wall-paper indicates that the danger has been exaggerated. Prof. C. F. Chandler testified, that, from careful experiments, under no conditions could arsenical poisoning occur through breathing arsenurated hydrogen from wall-paper, and that the only source of danger would be from friction alone.

— Prof. L. Geiger of Berlin is about to issue a *Zeitschrift für die geschichte der Juden in Deutschland*. It will be scientific in character and treatment, and, in addition to essays and reports of research, it will contain summaries of historical materials that are difficult of access or hitherto unprinted. It will also make its bibliographical notes an especial feature.

— The Smithsonian report for 1884, just issued, contains, like the previous ones, the secretary's annual report, and summaries of scientific progress in the natural sciences, by E. S. Holden, C. G. Rockwood, F. M. Green, C. Abbe, G. F. Barker, H. C. Bolton, E. S. Dana, J. B. Marcou, T. Gill, and O. T. Mason, together with a number of miscellaneous papers on anthropology.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

New York agricultural experiment-station.

IN your review of the fourth annual report of the New York agricultural experiment-station (*Science*, vii. No. 165) you deal very leniently with some of the most glaring faults of that report. This is certainly the pleasanter way; but does it best subserve the cause of truth and progress? That station is unquestionably doing valuable work for the cause of progressive agriculture, and, because of the ability thus manifested, the anxiety of the friends of that cause is the greater that its splendid opportunities should not be frittered away in a kind of work which, if persisted in, will inevitably bring about its ruin.

The fundamental mistake in the management of this station, as manifested by this report, is the endeavor to cover too much ground. The field of agricultural experimentation is so vast, that he who would accomplish any worthy result must confine his labors to a limited portion of it; but in this case so many problems have been attacked, that few receive that close and careful attention which is the first requisite of truly scientific work. The director makes frequent reference to the necessary incompleteness and unreliability of isolated tests, and does good work in showing the variability of duplicates; but the infrequency with which he collates the results of his present experiments with those previously made by himself or other equally competent authorities, and the frequency with which he disregards his own testimony respecting the necessity for the duplication of tests, intensify the feeling that the value of a large proportion of the work of this station is seriously impaired by its desultory character.

The impression, that, in much of this work, quantity is attained at the expense of accuracy, is strengthened by page after page of the report. Typographical errors are difficult to wholly avoid; but it is putting the case very mildly to say that they occur with unnecessary frequency here. This point, however, might be passed without notice were these the only evidences of hasty or careless work. In the tabulated report of the experiment in feeding starch-waste, for instance, we are left to conjecture which columns of figures relate to hay, and which to starch-meal, while no practical feeder would have been guilty of the absurdity of feeding a rich meal *ad libitum*, and following it by hay fed in the same manner, where it was desired to make a scientific test of the feeding-value of either food. Under the circumstances, the allusion to the capriciousness of appetite in the cows under test is amusing.

The fertilizer test recorded on p. 40 affords another striking example, both of the crudity of the methods employed at this station, and of the carelessness in reporting results. What would the magnificent Rothamsted experiments have amounted to, had the plots in Broadbalk field received enormous dressings of fertilizers one year, none the next, and varying quantities in the succeeding years, or if their interpreter had shown such carelessness in the summarizing of results as has been shown in giving the total quantities of fertilizers used in this case?

In conclusion, I must wholly dissent from the idea conveyed in the closing paragraph of your review,

that an experiment may have a so-called practical value and yet be worthless to the man of science. What is science but accumulated and co-ordinated facts? What fact is there which confirms, disproves, or illustrates any supposed law of vegetable or animal growth, that is not valuable to the scientific man, and to the farmer as well? What agricultural experiment, worthy the name, but must perform this function? It is true, the farmer may be more interested in the results of the experiment, as in a comparative test of different varieties of wheat, while the scientist may be more desirous of ascertaining what constitutional peculiarity enables the one variety to surpass the other in yield; but in either case the fact that the one variety is the more productive is the stimulus of the investigation, and the methods of culture must be the same if trustworthy data are to be obtained for the use of either scientist or farmer. I do not forget that valuable facts have been learned from experiments which would be utterly impracticable in the field, and I would be the last to deny the usefulness of such work; but, until the applicability of these facts to the methods of the farmer has been demonstrated by field experiment, they are practically valueless. I do not deny that the study of isolated individuals, or of small groups of individuals, has a legitimate place in the work of the experiment-station; but, until the results of that study are shown to be applicable to the field or to the herd, they are worthless to the farmer, and equally worthless to the scientist. But this demonstration must be made by men trained to the scientific method.

C. E. THORNE.

Settlement of labor differences.

Last week's *Science* contains some views of Mr. N. M. Butler on the 'Settlement of labor differences,' which claim to be from the stand-point of 'science and philosophy,' which is explained to mean freedom from false notions and prejudices, and to be the observation of facts and relations as they are.

He says that 'we' are apt to look upon the present economic system as fixed and final. Who are 'we'? 'The fact as it is,' is that in America, England, France, Germany, etc., men by the thousands and hundreds of thousands most decidedly do not feel that way at all. Numerous American citizens known as Knights of labor have combined and organized for the express purpose of changing the present wage (i.e., private capital) system into an integral co-operative one; and, what is more, they work with earnestness, determination, and devotion to realize that end. Instead of "feeling an irresistible desire to look upon the (social evolution) process as completed, and the book of evolution as closed," they feel an irresistible conviction that society is entering on the threshold of a new form of economic organization. This belief is scientific; that is, it is based on experience carefully made and closely analyzed, as may be seen in the works of Karl Max, F. Engels, Henry George, and very clearly in that American writer George Gronlund's book, 'The co-operative commonwealth.'

Mr. Butler says something about "the ethical fact that there is a superiority of possessions." What can it mean?

Mr. Butler adds his voice to the chorus of 'arbitration' fetich-worshippers. Arbitration is to have 'magic' results. So it must, if it will harmonize the interests that are diametrically opposed, as are those of capitalists and laborers in regard to sharing the product of labor.

But, say the 'arbitration' and 'harmony' preachers and Mr. Butler, the product is the combined result of the efforts of the capitalist and laborer. Sometimes the capitalist adds his efforts to the work of producing by direct labor, or indirectly by doing the requisite directing of the work, and sometimes he does not. When he does apply personal effort, he is entitled to reward; but that is a different thing from the profit on his capital which will go to him if he hires managers or agents, or is merely an investor or shareholder in a business he neither does nor can manage, nor in any way add 'effort' of his own to the work of production.

No, the capitalist need not work. He can (and many do) live in idleness, consuming enormously without producing at all, and, on an average, he never gives an equivalent of effort for what he gets: hence there is want of equity in the capitalistic system.

It is self-evident that no arbitration, but only a radical change of the system, can abolish this injustice; and this injustice is the cause of the 'labor differences.'

'Christian charity' will not suffice here; that is, the 'give all you have to the poor' doctrine will not do, but, rather, a modernized adaptation of the institutions of the primitive Christians, who had some primitive form of integral co-operation, for they held 'all things in common' (see the story of Ananias).

As to arbitration as a sort of palliative patchwork for making temporary compromises, perhaps it is good for that; but 'brute force,' in the form of police and militia, has to stand behind it to make capitalists keep their agreement, which they have broken in innumerable instances when it was in their interest and power.

Whether the change from the capitalistic to the co-operative mode of production will be by 'brute force' depends on the resistance the capitalists make to the course of evolution. History shows that privileged classes generally have appealed to brute force whenever their privileges were in danger.

The advice of science they do not heed. It is interest that guides them. Science, that is, our judgment of future facts by past ones, says the course of evolution of human society tends to abrogate all privileges and equalization of rights and duties. This is the democratic principle. When applied to social economy, it is termed 'socialism' or 'social democracy.' The capitalist cannot be a mere trustee without first ceasing to be a capitalist. This implies an entire change of the laws of property: hence the advice of science to labor is, Organize to make the requisite change of laws; that is, go into politics as a party to establish an economic republic, *electing* your directors of labors. That will settle all differences between capital and labor, because there will be no capitalist, and all will be laborers or starve.

CHAS. FIELD.

Eskimo building-snow.

In your issue of Jan. 15, 1886, you give an illustration of what purports to be 'hardened snow' impacted on a Mount Washington telegraph-pole by a strong gale. During the past winter I have

noticed the same formation at this station upon the anemoscope and anemometer. I would like to inquire whether the Mount Washington formation is really snow driven against the pole by the gale, or, as at this station, an accumulation of fog in a frozen state. This formation I have never observed during snow-storms, even when accompanied by winds of sixty miles and upwards, but it is of frequent occurrence when a heavy cloud envelops the peak.

T. W. Sherwood,
Sig. corps, U.S.A.

Pikes Peak, Col., April 15.

Quaternary volcanic deposits in Nebraska.

It was the good fortune of the writer to discover the following significant section during the last holiday vacation. It is in one of the abrupt bluffs overlooking a sharp bend of the West Blue River, in the southern part of Seward county, Neb. It exhibits the formations from nearly the general level down to the level of the stream. It is as follows: 2 ± feet soil; passing into 6 ± feet red gritty loam; 9 ± feet stratified loamy clay, with thin streaks of small white quartz pebbles; passing into 3 ± feet mostly gravel, with a few bowlders of red quartzite from Dakota; passing into 15 ± feet stratified loamy clay with streaks of pebbles; 6 to 10 inches of light gray earth, volcanic ashes, thinly and evenly laminated; 1½ feet clay, darker above; below passing into 5 feet fine gray sand, with thin clay laminae 6 to 12 inches apart; 1 ± foot coarse sand with pebbles and bowlders of red quartzite, — greenstone, — granite, etc., with an uneven surface below; 6 feet hard greenish joint clay; 8 feet slope; water of the West Blue River.

A few rods distant a less complete but similar section shows the siliceous layer five feet thick, and it appears along the sides of a ravine at different places for several rods, showing considerable persistency. Specimens of it have been submitted to Mr. J. S. Diller of the U. S. geological survey, with another sample from Knox county. He replies, "Specimens No. 1 (Knox county) and No. 2 (Seward county) are volcanic dust. They are composed chiefly of minute angular fragments of pumiceous glass, such as is thrown high into the air during violent eruptions, and wafted by currents of air for hundreds of miles away from its source. The fragments of glass are, for the most part, clear and transparent, with few traces of crystalline matter. Besides the volcanic glass, there are numerous grains of quartz sand, which are well rounded. . . . As nearly as I can estimate, from the small quantity examined, more than ninety per cent of the whole is volcanic dust. It appears that the material is of complex origin. While there is no doubt that the volcanic dust was borne by winds nearly or quite to its destination, the rounded grains appear to be of aqueous origin, and suggest that the dust may have fallen in a body of water, where the two commingled."

Several important conclusions seem well-nigh demonstrated by this section.

1. The occurrence of important volcanic action somewhere in this region during the quaternary. The red quartzite could not have arrived in this locality before the glacial epoch. If the section eventually proves to be of a local formation, which does not seem likely, it would only make the deposition of the dust more recent.

2. The character of the siliceous deposit strongly supports the conclusion that it was dropped in a deep or quiet lake. This accords well with the deposits above and below; for the bowldery layers are, for evident reasons, referred to floating ice, and the character of stratification favors lacustrine rather than fluviatile conditions: hence we are led to believe that this lake was contemporaneous with the ice-sheet which occupied the regions of Dakota and Iowa. We catch a glimpse of the joint action of frost and fire on our western plains.

3. From the location of the section, and its relation to the White River tertiary sands, which, if rightly identified, are widely exposed east of this point, it appears not unlikely that this lake was but the diminished stage of King's Lake Cheyenne. Numerous finds of these siliceous beds have been reported from the republican valley, and one as far east as Oak Creek, Lancaster county. They probably belong to this same geological horizon.

J. E. Todd.

Tabor, Io., March 20.

World time.

The last number of *Nature* contains a lecture by Mr. Christie, the astronomer royal of England, on universal or world time. With Mr. Christie's principal conclusion I fully agree, but have not much faith in some of his arguments, or in some of the results he predicts.

Mr. Christie bases one of his arguments on the ignorance of farmers, and infers, that, because the farmer cannot tell a difference of half an hour in his time, we may therefore make this difference four, five, or ten hours. But would the farmer be any better off if he should tell his wife that he wants breakfast at sixteen, seventeen, or twenty-two o'clock? Of course not. And it is not wise, I think, to base any permanent action on the ignorance of any class of men. Conditions may change; and such arguments, though they may answer for a political or military campaign, are easily overdone, and must be looked upon as only temporary.

The most vicious assumption that underlies Mr. Christie's argument, and which he has in common with some other astronomers, is this: he assumes that man was made for railroads and telegraphs, and not that these things are for man. My natural assumption would be that the chief astronomer of a great country would have a wider view of things. But we all know the liberality and influence of our great corporations, and how they deal out free wires and free service; and we have all felt this on the reception of a free telegraphic despatch when we come to the last letters, *D. H.*

Now, I say with Mr. Christie, let the railroads adopt a world time, and it does not matter what meridian they take, though Greenwich is probably the best, and let all their trains be run on this time. Then, directly opposite to Mr. Christie's proposition, let all the cities, villages, and farmers return to their local and natural time. If the railroads will do this, the most ignorant farmer will soon understand matters. I speak with confidence, because forty years ago I was a farmer myself, and very ignorant. There has been too much confusion given to this matter, and our astronomers have been too eager to sell time. They have better work to do.

Asaph Hall.

Certain questions relating to national endowment of research in this country, and their importance.

In reply to your able critic (W. S. N., in *Science*, vii. No. 165) of my letter bearing the above title (No. 164), permit me to refer him to my articles upon science and the state, recently published in *Mind in nature*, of Chicago, and, if his interest carry him that far, to do me the simple justice of re-reading my letter in *Science* which prompted his questions, — questions which I will here endeavor to answer for him.

In the first place, let me most emphatically reiterate my opinion, that I am fully in favor of the government endowing researchers in civil life, as well as affording the proper opportunities for the successful prosecution of the labors of those scientists upon her own rolls. May I ask my critic to again peruse that paragraph in my letter that is completed with the following words, "I stand on the side of the King of Denmark, in his principle as applied to Tycho Brahe," and then ask himself if my being interrogated as to my convictions upon the question as to whether or no it devolves upon the government to aid researchers in civil life was necessary; and I think he will find, upon reconsideration, that there is no difference of opinion between us upon that point.

As to the proper ones who should receive such aid from the government, either in civil life or the services, let my critic place the correct construction on the word 'demonstrated,' when I say in the sentence he quotes from my letter, "of those persons in her employ who have from time to time demonstrated their fitness to perform certain work," and I must believe we will agree here also. Mind you, I am not in favor of promptly affording assistance to any one and every one, or to him who suddenly springs up, and exclaims, "Lo! I am a scientist, I can write a book. I believe I am an investigator and a genius." My advice to such a person would be, 'Demonstrate it, my good friend.' As to the amount of assistance the government should render to those exceptional persons in this country who have demonstrated their peculiar fitness to prosecute certain lines of research with marked success, I concur fully in the opinion of Professor Huxley, who says, "Now, the most important object of all educational schemes is to catch these exceptional people, and turn them to account for the good of society. No man can say where they will crop up; like their opposites, the fools and knaves, they appear sometimes in the palace, and sometimes in the hovel. But the great thing to be arrived at, I was going to say the most important end of all social arrangements, is to keep these glorious sports of nature from being either corrupted by luxury or starved by poverty, and to put them into the position in which they can do the work for which they are specially fitted." I quoted these excellent words nearly three years ago in the New York *Medical record*, and again in my article upon science and the state in *Mind in nature*: so there is some danger of their becoming immortalized, though I considered them immortal when they were first penned. I will say, however, that, if occasion requires, I will quote them again, —quote and quote, till they become even the battle-cry of the socialists themselves.

Regarding the progress of our nation, from an evolutionist's point of view, as I do, I must consider, from the very limpets in our fauna, through every atom we lay claim to, our bodies and brains, our minds and our works, our institutions and industries, our opinions and our language, nay, through our very government itself, — I must consider, I say, the whole as one glorious growth and development. During this growth, that limb of the common tree which bore the crop of American scientists undoubtedly did encroach upon the government service; and to the extent of this encroachment only do I "claim a monopoly of talent in government employ."

It was from this broad basis that I attempted to write my letter upon national endowment, and I feel pained that I should have failed in anybody's eyes. My suggestions for a scientific corps for the army and navy, my papers upon science and the state, were prompted solely through the same sentiment.

Is it too much to hope that some such re-organization as the department of science that I have elsewhere suggested, may some day be an idea realized, or do I peer too far into the future, when I see other zoölogical stations scattered along both of our extensive coasts, repeating, and repeating again, the magnificent national work that has been accomplished by the staff at Wood's Holl? Or, scanning the horizon still farther, is it too much to hope that somewhere in the dim future that change may come o'er the dream of the official mind, and it, too, see the grand natural law that the nineteenth century has wrested from nature's secrets, and that the principles of evolution which are becoming more clearly defined for us every day be turned to practical use, and a little bending of the twigs be done by the government, to the extent of utilizing these evolved products for the nation's good? Then those who have demonstrated their peculiar fitness will be taken up by the government as one of her most powerful weapons; and room will be found for their strength, in this very department of science, these zoölogical stations on our coast, and similar zoölogical and meteorological stations established, as they should be, at suitable points all over our broad empire.

R. W. SHUFELDT.

Fort Wingate, N. Mex., April 8.

The American ornithologists' union code and check-list of North American birds.

By an unfortunate oversight, the committee of the American ornithologists' union on classification and nomenclature of North American birds omitted to recognize in the preface of the 'Code and check-list' the important aid rendered the committee by the gentlemen invited to share in its labors. Dr. L. Stejneger, Dr. C. H. Merriam, and Dr. T. N. Gill were present at numerous meetings, participated in the discussions, and are entitled to grateful recognition by the committee for their services.

Dr. Stejneger not only gave valuable assistance to the subcommittee on species and subspecies, particularly in relation to questions of synonymy, but was also present by invitation at most of the meetings of the whole committee, took an active part in its discussions, and contributed valuable assistance in the formulations of the 'Code,' — assistance which the committee is glad to gratefully acknowledge.

COMMITTEE OF THE AMERICAN ORNITHOLOGISTS' UNION ON CLASSIFICATION AND NOMENCLATURE.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 23, 1886.

CHANGE IN THE TENETS OF POLITICAL ECONOMY WITH TIME.

"IT is incontestable," says Comte, "that continuity and fecundity are the least doubtful symptoms of all truly scientific conceptions. When each new work on political economy, in lieu of presenting itself as the spontaneous sequence and gradual development of previous works, has an essentially personal character according to its author, so as to repeatedly put in question the most fundamental notions," then we can rest assured that we are not dealing with a science properly so called.

It is not the intention of the present paper to combat this statement in its entirety; for the maturer judgment of the scientific world has convicted Comte of a gross misconception as to the nature of economics. But one charge must be met, — a point that contains the very marrow of the new movement in political economy. What Comte predicated of sociology, but denied in speaking of political economy, and what many of the older school then, as now, often disregarded, is the essential interrelation between economic theories and the changing external conditions of industrial life. The modern school, the historical and critical school, holds that the economic theories of any generation must be regarded primarily as the outgrowth of the peculiar conditions of time, place, and nationality, under which the doctrines were evolved, and that no particular set of tenets can arrogate to itself the claim of immutable truth, or the assumption of universal applicability to all countries or epochs. We do not wish to disparage the work of previous economists; but, just because of our belief in the relativity and continuity of economic doctrine, we are compelled to regard much of what was at the time comparatively correct and feasible, as to-day positively erroneous and misleading. We maintain that Comte's criticism is specious and shallow; we hold that there is a well-defined thread of continuity and gradual development in the history of economic doctrines: and we assert that each period of economic life must be treated by itself, both in regard to the truth or falsity of the doctrine itself, and in regard to the applicability of the particular theory in question. Let us, then, first give a short sketch of the history, and then draw our conclusions.

1. The science of political economy in its present form is essentially a creation of modern thought. The conditions that have given rise to its birth are peculiarly the development of the last few centuries. Classic antiquity can indeed show us several writers on economic topics; but a complete science, as we understand it, was an impossibility, because the whole environment was of a nature to preclude speculation of this kind. The one great fact which pervaded the whole national life in Hellenic antiquity, for instance, was the institution of slavery. In Greece the home of almost every rich freeman was a great complex. He owned the land, the house, the slaves; and he produced at home, on the premises, all the necessary articles of consumption, which again, in cases where exchange was desirable, were taken to market by his own slaves, and sold as his own property. This complex of possessions was called in Greece οἶκος (originally, 'a house'), and the word 'economics' (οἶκος and νομὸς, 'rule') primarily denoted the method of managing this property, thus including domestic as well as political economy. But there was no fundamental distinction between real and personal property, between movables and immovables, between land and capital, as in modern times, because the same individual always owned both. There was no distinction between labor and capital, because labor was regarded as a part of capital, because the laborer was property, because the slave was put in the same category as land and other commodities. Landowner, capitalist, employer of labor, who are to-day sharply distinguished in production, were thrown into one in antiquity. The slave being a part of this complex, no independent theory of wages could arise, since there were no wages; the landowner being the capitalist, no theory of rent could arise; the capitalist being the employer of labor and the transporter of goods to market, no theory of interest and profits, no conception of wages of superintendence as a separate share in distribution, could arise. The οἶκος is therefore a fact of the most fundamental importance in Greek life, and furnishes the clew to all the theories of Aristotle and Xenophon, which, without it, are incomprehensible and seemingly illogical.

The second distinguishing mark of Greek life was the general conception of state. The present century is the age of individualism: the Hellenic epoch

was what might be called the age of collectivism. There the state reigned supreme: the individual as such was swallowed up. His time, his property, his life, belonged in the last instance to the state, which might demand it at any time. The only occupation worthy of a full citizen was that of attending to public affairs. Statecraft and politics, athletics and military exercises, engrossed the chief moments of every Grecian, and left him neither time nor inclination for the pursuit of manual labor. This conception of the state was perhaps carried to an extreme in Sparta, where, as is well known, the meals were eaten in common, the children educated together under the superintendence of the state, and the marriage relation subordinated to considerations of imagined political necessity.

In Rome the matter was not far different. The economic conditions were for many centuries essentially the same as in Greece, and the ideas, even as advanced in the code of Justinian, bear evidence of the incomplete development of economic theory. Slavery, the low estimation of manual labor, and imperial absolutism, were the distinguishing characteristics of national life; and under such conditions a science in the modern sense was rendered impossible. The Romans, however, had their physiocratic school, during the empire, in the shape of the agrarian writers, — *scriptores de re rusticâ*, such as Varro, Columella, etc., — who attempted to stem the tide of national decay, and to recall the Romans to a sense of their former strength, by sounding the praises of agriculture, and by proving the economic as well as moral shortcomings of the system of servile labor.

2. The growth of the Christian church—the substitution of a great monotheism for the numerous polytheisms of antiquity; the change from the old cults, which were but national religions or consecrations of the national idea, to the new worship, which was international, not national, and intended to embrace all humanity — brought in its train the most cardinal changes. This is, of course, not the place to recount the changes produced in economic relations by the church teachings: it will suffice barely to mention the total alteration in the treatment of the poor, the improvement in the condition of woman, the conception of the dignity of labor hand in hand with the institution of holidays for the workmen, and the efforts for emancipation of the slaves. The patristic authors even went so far as to preach practical communism, although their object, far from being that of inciting the rabble to resistance, or of sowing the seeds of discord, was simply to recall the wealthy to a sense of their own obligations, to preach the gospel of fraternal love and charity, to remove some of the hideous moral enormities with which the later imperial civilization was honeycombed.

But it was not until the scholastic age that any distinctive economic doctrines were formulated. The increase of industry and commerce in the eleventh and twelfth centuries, the rise of the municipalities and the growth of the town-guilds, craft as well as merchant, lent an increased impetus to the consideration of economic topics, — an impetus still further strengthened by the discovery and annotation of Aristotle's 'Politics and economics.' The subject of money, for instance, received a careful treatment, and the so-called Gresham's law was as well known to the authors of the fourteenth and fifteenth centuries as it is to-day. The two great doctrines, however, that dominated all mediaeval economy, were those of usury and of reasonable price. The prohibition of interest was founded, not on Aristotle's plea that money was barren, nor even, except at the very first, on the injunction of St. Luke, *Mutuum date, nihil inde sperantes*, but on a complicated and artificial legal distinction, drawn from the Roman law. The theologians based themselves on the glossators and legists, and the wordy strife about 'fungible' and 'consumptible' things continued for several centuries, until finally settled by Salmasius, Turgot, and Bentham. But the doctrine influenced all mediaeval speculation: it was applied not only to loans, but to transactions of all kinds; it was the pivot about which the theories of price, of exchange, of banking, and of trade, swung; and an acquaintance with its provisions is indispensable to a correct comprehension of mediaeval economic life.

Of still greater importance, however, was the doctrine of *justum pretium* ('reasonable price') as expressed in the writings, and exemplified in actual life. The middle ages were a period of customary, not of competitive prices; and the idea of permitting agreements to be decided by the individual preferences of vender or purchaser was absolutely foreign to the jurisprudence of the times. The 'higgling of the market' was an impossibility simply because the laws of the market were not left to the free arbitrament of the contracting parties. Under the supposition that the interests of the whole community would be best subserved by avoiding the dangers of an unrestricted competition, the government interfered to ordain periodical enactments of customary or reasonable prices — reasonable, that is, for both producer and consumer. Tabulated tariffs and official regulations of all things, from beer to wages, filled the statute-books; and it would have seemed preposterous for the producer to ask as much as he

could get, or, on the contrary, to demand less than his neighbor, and thus undersell him. The great offences of mediaeval trade in England, for instance, were regrating, forestalling, and engrossing, — buying in order to sell at enhanced prices, intercepting goods on the way to market to procure them more cheaply, and keeping back wares purchased at wholesale in order to strike a more favorable bargain subsequently. But, above all, great solicitude was shown for the interests of consumers, and every precaution was observed to preclude the possibility of overreaching the public. It was deemed of paramount importance to watch over every stage of production; and the whole institution of craft-guilds was nothing but an adjunct to the municipal administration in the endeavor to attain this end. Erroneous and misguided as was some of this legislation, there is no doubt that it was the outgrowth of moral ideas, and to a certain extent justified by economic necessities. *Justum pretium* was the manifestation of a great moral principle, and until the decay and disintegration of the guild system, through the growth of competition and the development of a distinctively capitalistic class, set in, the mediaeval doctrines and institutions were undeniably well suited to the exigencies of economic life.

3. The so-called mercantile system was simply the manifestation, in one particular direction, of the general mediaeval conception of national polity. The commonly accepted notions of its teachings form nothing but a distorted caricature, and it would indeed be surprising if a set of ideas upheld by the leading minds for many generations should be such a tissue of absurdities as some would have us believe. The earliest writers, such as Bodin in France (1578), and Stafford in England (1581), had their attention called to the general disarrangement of industry and prices, caused in great part by the influx of bullion from America and by the gradual development of competition, as against custom. Their ideas, as expanded in the seventeenth century by English and continental economists, were simply to foster industry, to increase population, and thus to bring about a general prosperity. The great writers of the times never entertained such an absurd idea as that wealth consisted of money; they, indeed, had a somewhat exaggerated opinion of money as an evidence of national prosperity, and some of them laid undue weight on the importance of the 'balance of trade' argument: but their ultimate aim was national aggrandizement through industrial as well as commercial supremacy. The economic policy of Colbert, of Frederick of Prussia, does not at all correspond with the accounts usually advanced, and was in reality dictated by considerations of the highest statesmanship, and in many respects eminently well fitted to the necessities of the period. The prominent English writers of the seventeenth century, such as Child, Petty, North, Locke, etc., entertained opinions on the subject of international trade, which closely approximate to the principles laid down by Ricardo and Cairnes in this century. Their ideas on the nature of national wealth, moreover, were in the main correct; and they perceived and explained with lucidity the shortcomings of the industrial system, which was then gradually becoming unsuited to the altered conditions of the period. The English authors struggle for free trade, in the sense of freedom of exportation; the Italian Serra (1613) invokes the principle of 'liberty of contract;' the Frenchman Montchrétien (1615) does not think of subordinating agriculture and industry to commerce.

The mercantile system, even in its crudest form, showed that statesmen and authors began to form some conception of a national economy. Practical economic systems can never be entirely divorced from political considerations; and it is these political considerations alone which enable us to understand some of the fundamental mercantilistic notions, such as the desire for increased population or the 'balance of power' argument. The mercantile system formed a fitting pendant to the political attempts of the absolute monarchy. which the new political science has taught us to regard not only as a necessary, but as a most salutary, step in the advance from mediaeval feudalism to modern constitutionalism. The doctrines themselves underwent a gradual modification, and in their final form simply taught that the real advantage lay in the stimulation of production and the greater activity of industry. The mercantile system had, at the time, undeniably a certain historic justification.

4. In the eighteenth century, however, the system, with its restrictive measures and its illiberal policy of national exclusiveness, had become antiquated. Inquisitorial custom-houses and tariff wars were multiplied; industry was fairly throttled by minute regulation of details: in France alone four large quarto volumes were filled with complicated, unintelligible, and contradictory regulations of manufactures. The confusion was heightened by the excesses of the monopolistic companies and the degeneration of the craft-guilds, which now, far from being welcome auxiliaries to the municipal administration, had become oppressive, exclusive bodies, with an hereditary, caste-like organization. What wonder, then, that a sect of men should arise who

sought refuge from this intolerable pandemonium of perpetual interference in the soothing doctrine of absolute liberty? The times were ripe for a reaction, — a reaction in every sphere of life, political, religious, economic. In politics this was ushered in by Rousseau, in philosophy by Voltaire and the encyclopedists, in economics by the advent of the physiocrats. The great significance of the physiocrats, as their name denotes, is the belief in the natural order of liberty; their tenets of *produit net* and *impôt unique* being subordinate doctrines, which grew out of their endeavor to rehabilitate agriculture, and bring the dissolute classes back to a sense of primitive simplicity. Just as the mercantilists had laid stress on the national element, applying the principles of domestic economy to political life, so, on the other hand, the physiocrats represented the universal, the cosmopolitan, the international view. In that confused progeny of stoic philosophy and Roman law as nurtured by the continental jurists and philosophers, and known as the law of nature, Rousseau found the life-blood of his *contrat social*, the support of his revolutionary theories. And the same misconception led Quesnay and Gournay to formulate the laws of industrial society as eternal and immutable truths, which it was the function of man to expound, but which it would be utterly impossible — or, if possible, utterly ruinous — to change or tamper with. *Laissez-faire, laissez passer*, is the key which unlocks all economic puzzles. The 'be quiet' system, as Bentham calls it, is the sole panacea for human ills, the only hope of social regeneration. Give free play to the natural laws of liberty and equality, and prosperity will soon shine in all its refulgence on the expanse of national life.

The great statesman and economist, Turgot, undoubtedly made a move in the right direction in the celebrated six edicts of 1776, which abolished the guilds and the *corvées*, and reformed the corn-laws. The *economistes*, indeed, were indefatigable in their opposition to the abuses of the powerful to the privileges of the few. In the place of restriction they demanded freedom, in the place of nationalism they demanded cosmopolitanism, in the place of paternal government they demanded individualism. In every respect the sheer opposites of their predecessors, the physiocrats, beyond all cavil, sounded the just note of discontent with prevailing theories and institutions, which had become utterly unsuitable and anomalous; but their enthusiasm for reaction made them overshoot the mark, and go to the other extreme. An excellent work was done in clearing up the old errors as to the function of government, but it is almost too much to expect from the physiocrats the consciousness that they also were going too far. They could not be expected to foresee that the absolute reign of the 'let alone' system would produce, as it has done, evils almost as great as those against which they battled. Physiocracy was a timely and necessary movement. The ardor of its advocates in the search for economic laws enabled them to throw great light on the subjects of the division of labor, capital, wages, interest, and profits; and the only fault that can be found with them is, that, in unduly exaggerating the possibility of individual self-interest as an emanation of natural law, they laid the germs of a doctrine which was in future decades to prove an obstacle to a well-rounded social reform.

5. It is well known that Adam Smith, the greatest of all economists, owed much to the physiocrats, and that he was for some time a disciple of Quesnay. Many portions of the 'Wealth of nations,' in fact, are translations of and excerpts from the French writers; although Smith, of course, opposed their minor doctrines of the sole productivity of agriculture, and of the single tax on land, — a project which had already been formulated in the preceding century by John Locke. But Smith was far more than a slavish follower of the physiocrats. He took, indeed, many thoughts which he found in other authors, English as well as French; but he individualized their passing remarks, he placed them in such a connection that they became invested with a new significance, he clothed them in such a garb that they must henceforth be regarded as his own progeny. And this, after all, was a work of genius, for it is given to no man to be entirely original: every one is the product of the times, of the *zeitgeist*, and the ideas of the period are unconsciously reflected in the individual. So with the idea of liberty in Smith: he too was feeling the indefinable influence of the new current of thought, already partly expressed in Hume and Cantillon. Had he never seen the physiocrats, his ideas on liberty would have been the same, for both were an unconscious emanation of the spirit of the age.

Smith's thoughts were formed on the very threshold of the industrial revolution. In 1758 James Brindley built the first canal between Liverpool and Manchester, in 1769 the barber Arkwright re-discovered Wyatt's method of roller-spinning, in 1770 Hargreaves perfected the spinning-jenny, in 1776 Crompton patented his mule founded on the water-frame, in 1765 Watt discovered the use of steam as a motor power, and in 1785 Cartwright invented the power-loom. The house system of industry, which had supplanted

the hand system at the beginning of the eighteenth century, was now itself supplanted by the factory system. The conditions of English life were fast outgrowing the swaddling-clothes of official omniscience and governmental sciolism. In the town where Smith labored there were numerous protests, by individuals and by societies, against the antiquated policy of the government. It is not surprising, then, that, after a careful *résumé* of the shortcomings of the mercantilists' commercial policy and of the physiocrats' agricultural policy, Smith should have concluded with the celebrated passage, "All systems, either of preference or restraint, therefore, being thus completely taken away, the obvious and simple system of natural liberty establishes itself of its own accord. Every man, as long as he does not violate the laws of justice, is left perfectly free to pursue his own interest in his own way, and to bring both his industry and his capital into competition with those of any other man or order of men."

And yet Smith was too broad-minded to hold this doctrine without any qualifications, for he possessed a far truer historical spirit than many of his successors. He upholds the navigation law of Cromwell as a measure of the wisest statesmanship; he defends the necessity of export duties in certain cases: he confesses that the interests of individuals "in any particular branch of trade or manufacture are always in some respects different from, and even opposite to, the interest of the public." It cannot be denied that Adam Smith's philosophy was to a great extent correct: his doctrines most clearly showed the impolicy of the combination laws, of the acts of settlement, of the statutes which fixed the rates of prices and wages. Smith's whole work consisted in pulling down the rotten fences which obstructed the path of the artisan, the farmer, and the merchant, and we of to-day cannot be too grateful for the salutary impulse he thus gave to all economics. But what was then good, is not necessarily good to-day. We must not make Smith responsible for the faults of his disciples. The 'Wealth of nations' was written at a time when there was need of such a reaction as it undertook to initiate. Before building the new, it is imperative to tear down the old, and Smith certainly succeeded beyond his anticipations in demolishing the old principles. But since his time new conditions have arisen. The factory system, then in its infancy, has revolutionized industrial life, and has brought in its train problems which scarcely existed in 1776. The machinery of commerce and transportation is vastly more complex, and cannot be regulated by any such simple methods of *laissez-faire* as were possible when Smith wrote. It is, of course, not fair to take him to task for failure to perceive the consequences of his doctrines when applied under different conditions; but it is legitimate to protest against the acceptance, at the present time, of his views, in so far as they are one-sided and inadequate. Smith's work is by far the most important ever written in the science; but we must not, on that account, bow down blindly before its author, and meekly accept all his conclusions. Had we lived in 1776, we would certainly have been followers of Smith: did Smith live in 1886, he would no less surely have been in the vanguard of the new school.

6. On the lines thus marked out by the great Scotchman, Malthus and Ricardo continued the work. The one clarified all ideas on the subject of population, and threw light on some doctrines left obscure by Smith: the other sought to elucidate the complex problem of values, applying his peculiar theories to the law of rent, — of which he was the formulator, not the originator, — and being moderately successful in his treatment of currency problems. The outcries of late raised against the personal character of these two eminent economists are utterly groundless. Mackintosh expressly tells us, "I have known Adam Smith slightly, Ricardo well, Malthus intimately. Is it not something to say for a science, that its three great masters were about the three best men I ever knew?" And yet the exclusive predominance of abstract methods brought the two great followers of Smith to many faulty conclusions. In the case of Malthus, we have, as a result of his justifiable indignation against the poor-laws and the fantastic dreams of a Godwin, this curious spectacle. A benevolent clergyman, full of compassion and sympathy for the poor, feels himself impelled to declare that no possible efforts of government, no possible social movements or spontaneous plans to better their condition, can be of any avail. To the state he says, 'Hands off;' to the philanthropists, economists, and statesmen he cries, 'All you can do is ineffectual;' to the workmen themselves he declares, "Refrain from combination, the sole method of bettering your condition is to practise self-restraint." And in this remedy he himself puts little faith. The main causes of the distress he declares to be "to a great extent, and for a certain time, irremediable." And all this because of his firm belief in the natural laws, the immutable principles of an abstract political economy. Truly a sad spectacle, which would be absurd if it were not so sorrowful! It might be termed a philosophy of despair, a sad starting-point for nineteenth century economics. Fortunately modern investigation and recent events have proved the ground-

lessness of such a system of negation; they have shown that social reform is possible, and that rational improvement need not be checked by the bugbear of the wages-fund which Malthus and his followers set up as an absolute fact; they have demonstrated that other classes besides the workmen have duties to perform, and that the solution cannot be reached by declaring the laborers themselves the sole cause of all their own unhappiness and dissatisfaction.

Ricardo, again, with all his keen and penetrating analysis, based his apotheosis of free competition on insufficient foundations. The half-century that had elapsed since Adam Smith began his work, had converted the slow industrial change into a revolution. In the domain of international trade, indeed, the conditions had become peculiarly favorable for an application of Smith's doctrine, and Ricardo did an admirable work in paving the way for the anti-corn-law league of the forties. But the semi-metaphysical, the *a priori* element in the 'Principles of political economy and taxation,' produced a set of unreal and inapplicable conclusions. The theory of economic progress which formed the result of his labors is as unsubstantiated as it is pessimistic. Profits must fall, rent must rise, and wages must remain about stationary, not keeping pace, on the whole, with the advance of wealth and prosperity. In this there are some grievous misconceptions, not the least being the assumption of 'natural wages' and 'natural profits' varying in an inverse order to each other. But here, again, Ricardo is the child of the particular epoch in which he lived. His assertion that profits rise as wages fall, and *vice versa*, has lent the socialists of to-day the great argument of the necessary antagonism of capital and labor. Ricardo, curiously enough, passed over this, and drew the conclusion that the interests of laborer and capitalist are identical as against their common enemy, the land-owner. Wages and profits go hand in hand, opposed to the 'landed interest.' Who does not see that the peculiar conditions of England at this time were responsible for a theory which has lately been reformulated and exaggerated by George? Ricardo, indeed, was no enemy of the working-classes: his opponents, who term him 'a heartless worshipper of mammon,' 'the founder of the Hebrew-Caledonian school, thinking of nothing but the interests of money,' are, of course, guilty of an absurd exaggeration. Just because he wished for the welfare of the toiling masses, did he attempt to remove the obstacles in their path. He was an able advocate of the repeal of the combination laws in 1824. But his efforts were limited to removing the legislative obstacles: he did not yet perceive the necessity of removing the obstacles that were growing out of the system of free competition itself. During the years in which he matured his conclusions, the evils of the factory system had not yet become thoroughly developed or widely known. Ricardo's ideas were not yet entirely unsuited to the period, even though we of to-day must confess that his desire for abstract generalizations, founded on insufficient postulates, initiated a method of reasoning in economics, which led to many fruitless discussions and hair-splitting distinctions. We will not go so far as Jevons, in saying that "that able but wrong-headed man, David Ricardo, shunted the car of economic science on to a wrong line;" but we do maintain that his exclusive use of hypothetic methods — i.e., a system based on the hypotheses of natural law, coupled with a belief in the infallibility of self-interest — produced serious exaggerations and results, not in accord with the actual facts. Ricardo's theories are like rough diamonds, incrusted in dirt and sand; it is the duty of the economists of this generation to pare down and polish the edges, ridding them of their excrescences, disclosing in some instances the flaw in the jewel within, which renders it worthless, but showing in other cases that the core at least is sound, and capable of reflecting the light thrown on it by the lamps of recent experience.

The so-called orthodox school of England — McCulloch, Senior, James Mill, etc. — pursued an opposite course. Instead of clearing up, they increased the confusion; in lieu of modifying Ricardo's conclusions, they attempted to embed them more firmly in the unsubstantial foundations. One proposes to make of the science a mere 'catallactics;' another wishes to call it 'chrematistics,' a mere science of exchanges. All agree in venerating the absolutely immutable natural laws, which it is sacrilege to tamper with. The factory laws they deride; the trades unions they howl down; the growing abuses of the factories and the great corporations they have no eye for. "Labor is a commodity," they say: "if men will marry, and bring up children to an overstocked and expiring trade, it is for them to take the consequences. If we stand between the error and its consequences, we stand between the evil and its cure; if we intercept the penalty, we perpetuate the sin." They quote with approval Dignan's phrase, "To augment the annual production, to carry it as far as it can go, and at the same time to free it from all restraints, — that is the great object of government." No thought of any higher aims, of a more equitable distribution — simply the greatest possible increase of material commodities. And even the noble Cobden was

permeated with the narrow political philosophy of the time. But the labor question proved the rock on which the old school split. They lost supporter after supporter who saw the hollowness of the arguments, the inadequacy of the results. The professors and journals, in their very exaggeration of such opinions, began to be discredited. The science itself was fast losing its hold on thinking men, who were not satisfied with mere abstractions and what seemed to them practical obstructions to progress. The laborers looked upon economics as a science necessarily hostile to themselves; and this, too, notwithstanding the eloquent pleas of Bastiat, who attempted to prove that all interests are harmonious by natural law, and that it would be the height of folly to interfere with this beneficent progress. The economists were optimistic: the laymen grew pessimistic.

7. The first isolated mutterings of discontent came from France. Simonde de Sismondi already, in 1819, accused the orthodox school of "forgetting the men for the things; of sacrificing the end to the means;" of producing a beautiful logic, but a total forgetfulness of man and human nature. The positive side of Sismondi's arguments was, however, far less strong than the critical portion; and his protests, hence, fell on careless ears, although he led a small band of enthusiastic followers. Friedrich List, again, with his theory of nationality and of productive forces, did a good work in calling attention to the historic, relative element in all economic progress, but vitiated the effect of his 'national system' by turning it into an exaggerated plea for protection. The socialists, such as Weitling, Marlo, and Proudhon, uttered energetic and effective protests against the prevailing systems; and even in England able men like Thompson and Jones wrote large works to countervail the exaggerations of the orthodox school. But the new ideas first obtained a truly scientific basis about thirty-five years ago, when three young German economists — Roscher, Knies, and Hildebrand — proclaimed the necessity of treating economics from the historical stand-point. They initiated the new movement whose leading principles may be thus formulated: 1. It discards the exclusive use of the deductive method, and intonates the necessity of historical and statistical treatment. 2. It denies the existence of immutable natural laws in economics, calling attention to the interdependence of theories and institutions, and showing that different epochs or countries require different systems. 3. It disclaims belief in the beneficence of the absolute *laissez-faire* system; it maintains the close interrelation of law, ethics, and economics; and it refuses to acknowledge the adequacy of a scientific explanation, based on the assumption of self-interest as the sole regulator of economic action.

An entirely new impulse was thus given to scientific research. Freed from the yoke of a method which had now become sterile, the new school, devoid of all prepossessions, devoted itself to the task of grappling with the problems which the age had brought with it. The amount of actual knowledge, historical and theoretical, imparted by Schmoller, Held, Brentano, Wagner, and the host of younger economists, cannot be underestimated or neglected by any student. In Italy the entirely new spirit infused into economics is attested by a number of able writers; and even England has not lagged behind in the work. With Fawcett and Bagehot the last important representatives of the old school practically disappeared; Mill himself had gone through an evolution, and was sincere enough to express his disbelief in the old economy, and to a certain extent in his own book; while Leslie, Toynbee, and our contemporaries, Marshall, Ingram, and Cunningham, are thoroughly imbued with the new ideas.

What, then, has this historical *résumé* established? It has proved, in the first place, the relativity of economic doctrines. To maintain that all previous generations and countries have erred, and that we alone possess the truth, is an egotistic assumption, based, moreover, on the untenable hypothesis of the identity of human nature and the similarity of outward conditions. Our economic system is not necessarily the only true one: there will be and have been as many systems as correspond with the current conceptions and institutions. Many of our economic ideas are based on the postulate of absolute right of property, or on the supposition of the necessary division of producers into employers and employees. And yet we know to-day that private property is not an absolute natural right, but that it is, on the contrary, a comparatively recent conception, an institution justifiable only on the grounds of expediency, and whose extent may be limited again by these same considerations of expediency; it is a question, not of right, but of arrangements which will inure to the greatest possible social prosperity. Again: the distinction between employer and employee is not a necessary one, inherent in the nature of things: the very basis of the mediaeval guild system, in so far as it had a distinctive characteristic, was the identity of employer and employee, the amalgamation of capitalist and laborer in the same individual. How, then, can we speak of the unchangeable laws, good for all times and all climes? In antiquity we have seen an economic system based on the complex household and the undoubted omnipotence of

the state: in the middle ages we have found a civilization founded on the all-engrossing conception of *justum pretium;* at the beginning of the nineteenth century we notice a *régime* of pure individualism, of unalloyed free competition. Must we not confess the relative justifiability of the early municipal regulations of trade and industry, or the bullionist idea of hoards of precious metals, in a time when warfare was perpetual and bills of exchange unknown? The truly historical mind will acknowledge, with Adam Smith, the immense benefits of Cromwell's navigation act, but will rejoice, with Cobden, at the repeal of the corn-laws; he will praise, with Gournay, the attempts to unshackle industry, but will deplore Ricardo's opposition to the factory acts; he will applaud Bentham's demolition of the usury laws, but will realize the legitimacy of recent endeavors to avoid the unquestioned evil of absolute liberty in loans. He will, in one word, maintain the relativity of theory; he will divest the so-called absolute laws of much of their sanctity, and thus henceforth render impossible the baseless superstition that all problems can be solved by appeal to the fiat of bygone economists.

But, second, we must repudiate the assertion that the new movement is a German movement. The discontent with the continued application of antiquated doctrines made itself felt in the valley of the Po, in the heart of New England, and on the banks of the Thames. It is true that Germans happened to formulate the discontent more systematically at first; but the present movement would ultimately have attained the same proportions had Roscher and Knies never lived, just as Adam Smith would have expressed his ideas had the physiocrats never existed. The new school is the product of the age, of the *zeitgeist*, not of any particular country; for the underlying evolutionary thoughts of a generation sweep resistlessly throughout all countries whose social conditions are ripe for a change. The more extreme of the Germans, moreover, have themselves overshot the mark, have unduly undervalued the work of the English school, and have in their zeal too dogmatically denied the possibility of formulating any general laws.

Finally, we have established the continuity of political economy. The history of economics demonstrates how certain doctrines arose, developed in succeeding generations, and were ultimately overthrown, or, on the contrary, shown to be fundamental truths; how the teachings of successive schools or of individual writers developed the germ of scientific explanation, expanded the law and gradually stripped it of its inaccuracies and redundancies, until many of the complicated phenomena were shown to be manifestations of distinct and well-settled principles. The doctrine of international exchanges underwent a progressive modification, from Hume, Smith, Say, Ricardo, Mill, to Cairnes and Roscher. The theory of the wages-fund, on the other hand, as formulated by Turgot, Malthus, Senior, and McCulloch, was discredited by Herrmann and Sismondi, until finally overthrown by Longe, Brentano, and Walker; and in like manner with every other principle. The new movement in political economy simply intonates this progressive continuity. It maintains that the explanations of phenomena are inextricably interwoven with the institutions of the period, and that the practical conclusions must not be disassociated from the shifting necessities of the age. We accept with gratitude the results of former economists, as containing much of what was true at the time; but we protest against the acceptance of all their principles as practical guides for the present generation. We use the preliminary results of former decades as forming approximately secure bases; but we desire to erect a structure more suitable to the exigencies of the present. The paramount question of political economy to-day is the question of distribution, and in it the social problem (the question of labor, of the laborer), — how, consistently with a healthy development on the lines of moderate progress, social reform may be accomplished; how and in what degree the chasm between the 'haves' and the 'have-nots' may be bridged over; how and in what degree private initiative and governmental action may strive, separately or conjointly, to lessen the tension of industrial existence, to render the life of the largest social class indeed worth living. This and the other complex problems of the present day cannot be solved by a simple adherence to the principles of a bygone generation. The tenets of a bald individualism have been placed in the scales of experience, and have been found wanting. The continuity of political economy inculcates the lesson, no less profound than salutary, that there still remains something to be learned, and much to be done, before its teachings can be accepted as the loadstars of the present generation, — a lesson whose recognition will preserve us from two violent extremes: that of falling into a state of quiescent conservatism, which regards all that is as good; or that of adopting the vagaries of the radicals, who look upon all that is as bad, and who consider the foundations of the science itself as unsatisfactory as the positive institutions. The continuity of political economy teaches, in other words, the golden mean.

EDWIN R. A. SELIGMAN, Ph.D.

SCIENCE.

FRIDAY, APRIL 30, 1886.

COMMENT AND CRITICISM.

THE COMMISSION APPOINTED to investigate the various scientific bureaus of the government has submitted a partial report on the result of its labors, and has draughted a bill restricting the work and publications of the geological survey. Briefly, the measure provides, that, after June 30 next, no money shall be expended except for the collection, classification, and proper care of fossils and other material; no money is to be used for paleontological work or publications, nor for the general discussion of geological theories. The survey is to be prohibited from compiling or preparing for publication monographs or bulletins, or other books, except an annual report, which shall embrace only the transactions of bureaus for the year. All collections of minerals and other material now or hereafter to be made by the survey, and not needed for the current work thereof, are to be deposited in the national museum. The works whose publication is discontinued may be published by the authors at their own expense, who are to be allowed to copyright their material. The secretary of the interior is empowered to sell all the laboratories and other property now in use by the geological survey which shall no longer be needed after the passage of the proposed bill, and the proceeds of the sale are to be turned into the U. S. treasury. The bill provides that all printing and engraving done for the geological survey, coast and geodetic survey, and hydrographic office of the navy department, and the signal bureau, shall hereafter be estimated for separately, and prepared in detail for each of the said bureaus. The full report of the commission on the other bureaus is expected this week. The members claim that there has been great extravagance practised in the publication of works by the geological survey, and they propose to stop these 'reckless expenditures.' The report of the commissioners is unanimous in their action on the bill reported.

This report will be received with much regret by scientific men. The effect, so far as it pertains to the U. S. geological survey, should the bill become a law, will be most disastrous, crippling, if not almost entirely destroying, the survey's usefulness. Such sweeping and radical measures seem ill-advised. The causes that have led to the result, it is not hard to discover. Personal errors in other branches of the government surveys, and the exertions of a number personally opposed to the present management, will have placed the survey in a position from which it will be impossible to recover in many years. We do not need to repeat the argument, except to emphasize it, that national aid in the publication of many scientific works is absolutely necessary. In Europe such facilities exist in endowed scientific societies that do not exist in the United States, and will not for many years to come. The result simply will be that such works will not be published at all, and science will be so much the loser. Permission to copyright the works published at the expense of the author will only evoke a smile on the part of scientific men. One can imagine the danger likely to accrue to the author of a thousand-paged quarto on tertiary vertebrates, from his work being ruthlessly stolen, and issued in cheap paper form. The work of the geological survey has been managed honestly: no accusations whatever have been sustained against it. Neither can charges of extravagance in general be urged. The survey has perhaps grown to be too extensive; but the evil by no means calls for such severe pruning. Aside from arguments which will appeal to scientific men, it must be borne in mind that the survey can best justify its existence by furnishing valuable results to the miner and the farmer; and these results can only be reached when the evidence of all pertinent branches of investigation are available.

ABOUT A YEAR AGO much interest was taken in the discussion of requisitions for admission to colleges, when it was known that the faculty at Harvard had taken action in favor of recommending a sound course in laboratory study of chemistry or physics as an alternative for the admission requirements in Latin or Greek. A second step in this direction is now taken in the report of a committee of the board of Harvard overseers to

that body, in which the following vote is recommended among others: "That, in the opinion of the board of overseers, it is advisable to permit a scientific substitute, in accordance with the terms of this report, to be offered by applicants for admission to the college for either Latin or Greek, one of these two languages always being required." The terms here referred to are substantially that the scientific substitute must be a real equivalent of the old language course in amount of time needed for it, and amount of training gained from it, and that this demands more than a 'text-book' and 'memory' study. The four members of the committee who present this majority report consider the scientific substitute above referred to as recommended by the college faculty an adequate one: a minority report from one member still maintains the need of Greek for all. Favorable action may therefore be expected from the overseers.

THE GREAT SUCCESS of the free lectures recently given at Columbia college by Professors Boyesen and Butler — applications for tickets to the second course numbering over two thousand — emphasize a point in university work that has been long and persistently overlooked; that is, the duty of the university toward the people at large. Our colleges and universities depend, for success and support, upon popular interest and encouragement. They are continually in want of money, and always desirous of attracting large numbers of students. A large endowment, provided it be judiciously administered, and a large body of students, constitute a successful university. Of course, the test of numbers is of itself of small value; but the college with a thousand students can create more enthusiasm, exert a wider influence, as well as find work for more instructors, than a college having only three hundred names on its roll. The test of numbers, then, stands not so much for itself as for what it implies and represents. But these two conditions of success — money and students — might be made much easier of attainment were the relations between the universities and the people closer than they now are. As a rule, the college professor is looked up to as a useless sort of individual, who knows a great deal, but whose knowledge is of a shadowy and unpractical character. Our professors are too prone to give encouragement to this opinion by shutting themselves up within the four walls of their studies and class-rooms, and producing no results of their labors that to the non-collegiate man seem practical. Persistence in this isolation must weaken the university, and cut it off from the very sources of its support. The university should have some message to the outside world that is of a less formal and abstruse character than that usually locked up in memoirs and the transactions of learned societies. For this the lecture-hall seems pre-eminently fitted, and through it can the university find that contact with the people that it so much needs. Especially in our large cities, and by the staff of instructors in our larger universities and colleges, is this plan feasible. For years the Johns Hopkins university has given courses of lectures on semi-popular subjects, and with great success; and now Columbia, in an informal sort of way, is trying the same experiment. Perhaps the great interest of the subjects of the courses that have already been given there — 'The tendencies of contemporary literature' and 'Education as a science' — have had much to do with the great success of the Columbia lectures; but we are fully convinced that a large variety of subjects, both literary and scientific, are capable of being treated by university professors in a way that will not only attract large audiences and be an educating influence among the people, but also bring life and strength to the university itself.

THE APRIL MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

THIRTY-NINE members attended this year at the spring meeting of the academy, and found Washington in its most charming vernal dress. If we except the visit of courtesy made to the President of the United States, the only social incident of importance was a reception at which the members of the academy met the members of the local scientific societies for which Washington is justly celebrated.

The academy determined by vote not to consider the nominations that had been made for membership, so that no new members were chosen. The expiration of Professor Agassiz' term of office as foreign secretary created a vacancy; and, as he declined re-election on account of ill health, Prof. Wolcott Gibbs was selected to succeed him. Gen. M. C. Meigs and Profs. S. F. Baird, G. J. Brush, C. A. Young, E. C. Pickering, and S. P. Langley were elected to the council, and the remaining officers held over.

During the past year the government has made

three requisitions on the academy for information and advice. In accordance with a request of the secretary of the navy, a committee was appointed to consider, first, the question of the adoption of the universal day by the scientific bureaus of the department; second, the advisability of sending an expedition to observe the solar eclipse of August, 1886; and, third, the propriety of erecting a new naval observatory on the site selected in 1882. This committee submitted its report some months ago (*Science*, vii. 208). At the request of the treasury department, a committee was appointed to consider certain problems connected with the classification of wool for tariff purposes, and their report has become the basis of action by the department. More recently the treasury department has called on the academy for information affecting the subject of the duty on opium, and a committee has been appointed for this purpose.

The academy is now charged with the administration of three funds intended to stimulate astronomic research, and the trustees of these funds have decided to use portions of their incomes for suitable medals. The Henry Draper medal is given for researches in solar physics, the Lawrence Smith medal for studies of meteoric bodies, and the Watson medal for any distinguished achievement in astronomy. The first award of the Draper medal was made this year; and it was given to Prof. S. P. Langley, in recognition of the importance of his researches in solar physics. The Watson medal, with an honorarium of one hundred dollars, was awarded to Prof. B. A. Gould, in recognition of his distinguished service to astronomy in founding and conducting the Cordoba observatory.

A biographical notice of the late Prof. Arnold Guyot, prepared by Prof. J. D. Dana, was presented, and a similar notice of Prof. John W. Draper by Professor Barker. Professor Dana's memoir gave an account of Guyot's early life which will be new to many of his American friends, and particularly called attention to the fact that Guyot had made a scientific examination of the Alpine glaciers two years before they were studied by Agassiz, and anticipated a number of his most important conclusions. In a paper read then before the Helvetic society, but never printed until 1883, Guyot pointed out that the upper portion of the glacier moves faster than the lower, that the middle moves faster than the sides, that the general motion is accomplished by molecular motion, and he advanced the hypothesis that the blue bands are phenomena of the original stratification of the formative snow. Priority in these matters was not claimed by him, because, when he became soon afterward associated with Agassiz in glacial work, it was agreed that Agassiz' share should be the study of the living glaciers, and Guyot's the study of the erratic phenomena and other vestiges of ancient glaciation.

The only loss by death during the year has been that of Prof. Edward Tuckerman of Amherst, Mass. Prof. W. G. Farlow was selected to prepare a biographical notice.

The scientific proceedings of the academy occupied the afternoons of the four days of the session. Twenty-three papers were read and discussed, and four others were read by title. A list of the papers in addition to those announced last week will be found in another column. Here we have space to mention only a few.

Dr. A. Graham Bell reported the progress of his research regarding the ancestry of the deaf. Discovering from the statistics of asylums for deaf-mutes, and from the data of the tenth U. S. census, that deafness is exceptionally prevalent in Chilmark, in Martha's Vineyard, and in Kennebec county, Me., he visited those districts, and investigated the history of families affected. The deafness in Kennebec county is connected with that of Chilmark, and possibly derived from it. In both districts there is abundant evidence of heredity, and especially of atavism. In the families affected there were also found blindness, insanity, idiocy, and deformity; and in the Chilmark locality there has been such consanguineal marriage as is common to sedentary rural populations. The distribution of deafness on the island is closely related to that of soils. The affected families extend over the entire island; but the affected individuals are, with two exceptions, confined to a district of peculiar geological characteristics, and the eastern boundary of this district has been designated by local students of vital statistics as the typhoid-fever line.

By invitation, Mr. R. E. Peary, U. S. N., described his plans for an expedition to Greenland for exploration in the interior. He proposes to make a preliminary excursion from Disco Bay, and afterward an expedition from Whale Sound to some point on the east coast, near the 80th parallel. He prefers for the interior work a party of three, with snow-shoes, skiddars, and sleds modelled after the Hudson Bay pattern.

Prof. S. P. Langley reported the progress of his investigation of the invisible spectrum. Whereas Newton determined the indices of refraction of light-rays of wave-lengths ranging from .0003 to .0007 mm., Professor Langley has carried the determination to wave-lengths of .0400. He has also demonstrated a simple relation between wave-lengths and indices of refraction. The indices

of refraction being plotted as ordinates and the wave-lengths as abscissas, the resulting curve is found to be an hyperbola.

Prof. Alfred M. Mayer, in describing recent work, stated that he had succeeded, by the use of a lens of ebonite, in inflaming various substances by the concentration of dark rays, for which ebonite is translucent.

Dr. S. H. Scudder gave a general account of the cockroach in the past and present. Of all insect types, this one is best represented in the rocks, and especially the older rocks. The carboniferous, especially, may fitly be called the age of cockroaches. The paleozoic cockroaches were larger, the more recent smaller, than the modern. Mr. G. K. Gilbert discussed the geological age of the Equus fauna, maintaining that it belongs to the upper quaternary (later glacial), and not to the upper pliocene, where it had been assigned by students of vertebrate paleontology.

THE DATA NOW REQUISITE IN SOLAR INQUIRIES.

IN order to obtain the greatest amount of assistance from observations of the eclipsed sun, it is necessary to consider in the most general way the condition of solar inquiry at the time the observations are made. If any special work commends itself to those interested in the problem, — work which may be likely to enable us to emphasize or reject existing ideas, — then that work should take precedence of all other.

Next, if the observers are sufficient in number to undertake other work besides this, then that work should be arranged in harmony with previous observations; that is, the old methods of work should be exactly followed, or they should be expanded so that a new series of observations may be begun in the light and in extension of the old ones.

In my opinion, and I only give it for what it is worth, the three burning questions at the present time — questions on which information is required in order that various forms of work may be undertaken to best advantage (besides eclipse-work) — are these: —

1. The true constitution of the atmosphere of the sun. By this I mean, are the various series of lines of the same element observed in sun-spots, e.g., limited to a certain stratum, each lower stratum being hotter, and therefore simpler in its spectrum, than the one overlying it? and do some of these strata, with their special spectra, exist high in the solar atmosphere, so that the Fraunhofer lines, represented in the spectrum of any one substance, are the result of an integration of the various absorptions from the highest stratum to the bottom one? This view is sharply opposed to the other, which affirms that the absorption of the Fraunhofer lines is due to one unique layer at the base of the atmosphere.

I pointed out before the eclipse of 1882 that crucial observations could be made during any eclipse, including the time both before and after totality. I made the observations: they entirely supported the first view, but I do not expect solar inquirers to throw overboard their own views until these observations of mine are confirmed; and I think one of the most important pieces of work to be done during the next eclipse is to see whether these observations can be depended upon or not.

One observer, I think, should repeat the work over the same limited region of the spectrum, near F; another observer should be told off to make similar observations in another part of the spectrum. I have prepared a map of the lines near E, for this purpose, showing those brightened on the passage from the arc to the spark, and those visible alone at the temperature of the oxyhydrogen flame. Whereas some of the spark lines will be seen seven minutes before and after totality as short, bright lines, some of the others will be seen as thin, long lines just before and after totality. We want to know whether the lines seen at the temperature of the oxyhydrogen flame will be seen at all, and, if so, to what height they extend.

2. The second point to which I attach importance is one which can perhaps be left to a large extent to local observers, if the proper apparatus, which may cost very little, be taken out.

With this eclipse in view, I have for the last several months gone over all the recorded information, and have discussed the photographs taken at the various eclipses in connection with the spots observed, especially at those times.

The simple corona observed at a minimum with a considerable equatorial extension (12 diameters, according to Langley), the complex corona observed at maximum when the spots have been located at latitudes less than 20°, have driven me to the view, which I shall expand on another occasion, that there is a flattened ring round the sun's equator, probably extending far beyond the true atmosphere; that in this ring are collected the products of condensation; and that it is from the surfaces of this ring chiefly that the fall of spot-forming material takes place.

If we take any streamer in mid-latitude, we find, that, while the spots may occur on the equatorial side of it, none are seen on the pole-ward side. I regard the streamers, therefore, like

the metallic prominences, as a sequel to the spot; and there is evidence to suggest that a careful study will enable us to see by what process the reaction of the photosphere and underlying gases produced by the fall of spot-material tends to make the spot-material discharge itself in lower and lower latitudes, as the temperature of the sun's lower atmosphere gets enormously increased.

The observations of Professors Newcomb and Langley at the minimum of 1878, on the equatorial extension, are among the most remarkable. Professor Newcomb hid the moon and 12′ of arc around it at the moment of totality by a disk of wood, carefully shielding his eyes before totality. Professor Langley observed at a very considerable elevation. It is therefore quite easy to understand why this ring has not been seen or photographed at maximum. At maximum no precautions have been taken to shield the eye; no observations have been made at a considerable elevation; while the fact that the ring, if it exists, consists of cool material, fully explains how it is that the photographic plates have disregarded it.

I would propose, therefore, that the repetition of Professor Newcomb's observations of 1878 be made an important part in the arrangements of the eclipse for this year. A slight alteration in the method will be necessary, as the ring will be near the vertex and the lowest point of the eclipsed sun.

3. Another point of the highest importance at the present moment has relation to the existence of carbon. Until Tacchini's observations of 1883, the only trace of carbon in the solar spectrum consisted of ultra-violet flutings. He observed other flutings in the green near the streamers in the eclipse referred to.

Duner's recent work puts it beyond all doubt that stars of class III. *b* have their visible absorption produced chiefly by carbon vapor.

On any theory of evolution, therefore, we must expect the sun's atmosphere to be composed to a large extent of carbon at some time or other; so that the highest interest attaches to this question in connection with the height in the atmosphere at which the evidence of carbon is observed. The existence of the ultra-violet flutings among the Fraunhofer lines tells nothing absolute about this height, although I inferred, at the time I made the announcement, that it existed at some height in the coronal atmosphere.

These three points, then, are those to which I attach special importance at the present time.

We next come to photographs of the corona. I believe, that, with our present knowledge, the chief thing we have to seek in such photographs is not merely the streamers and their outlines, which we are sure to get anyway, but images on a larger scale; so that in a series of short exposures we may endeavor to get some records which will eventually help us in determining the directions of the lower currents. At present we do not know absolutely whether these flow to or from the poles. My own impression is that the panaches at the poles indicate an upper outflow.

In coming to the photo-spectroscopic observations, I am of opinion, that of the two attacks which I first suggested for the eclipse of 1875, and which have also been used in the last two eclipses of 1882 and 1883, one of them should be discarded, and the whole effort concentrated on the other.

We have learned very much from the use of the prismatic camera, — one of the instruments referred to; but the results obtained by it are not of sufficient accuracy to enable them to be fully utilized. On the other hand, though the slit spectroscope failed in 1875, it succeeded with a brighter corona and more rapid plates in 1882; and, with a proper reference spectrum, every iota of the facts recorded can be at once utilized for laboratory work and subsequent discussion.

On these grounds, then, I would suggest that slit spectroscopes alone be used for photographic registration. I think falling plates should be used, and that the work should begin ten minutes before totality, and continue till ten minutes after; provided the slit be tangential, or nearly so, to the limb.

I may state that arrangements have been made here to take such a series of photographs on the uneclipsed sun; and, with the improved apparatus, I am greatly in hopes that we may get something worth having. J. NORMAN LOCKYER.

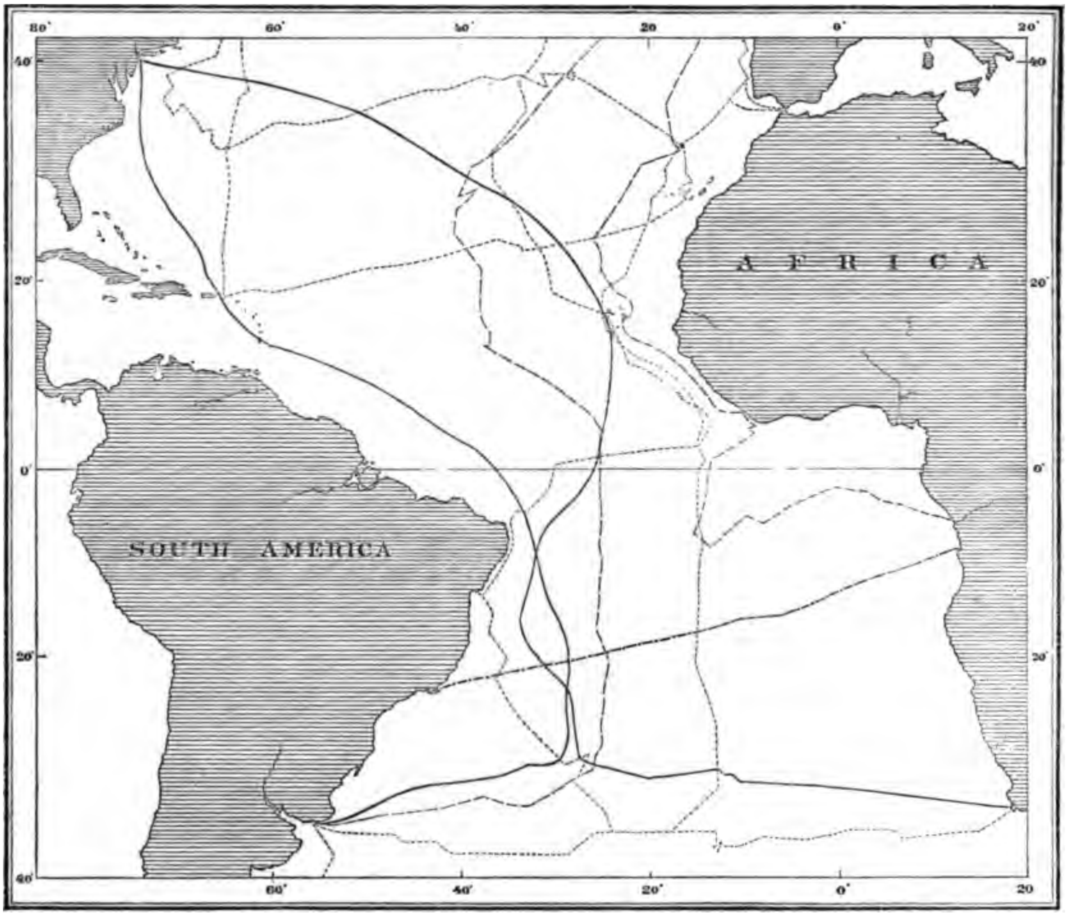
DEEP-SEA SOUNDINGS IN THE ATLANTIC.

THE U. S. S. Enterprise, Commander Barker, during her recent passage from Montevideo to Barbadoes, and from thence to New York, made a series of deep-sea soundings through the Atlantic Oceans which add considerably to our knowledge of the depths of those seas. Seventy-two casts were taken between Montevideo and Barbadoes, the distance run being 5,031 miles.

After leaving Montevideo, the course of the Enterprise was laid to the northward, towards Nelson shoal, where a depth of 2,088 fathoms of water was found, instead of 19 fathoms, as appears on all the charts of that locality. Commander Barker says, "From this point I steamed slowly, running from 200 to 250 miles to the northward of the Challenger's line, taking casts at in-

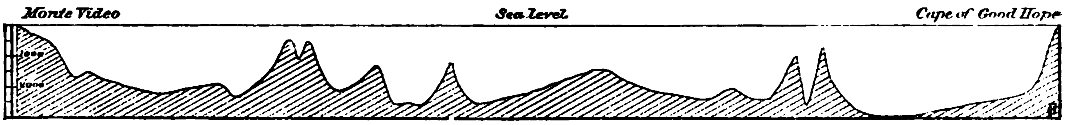
tervals of about sixty miles, the average depth being about 2,000 fathoms. In latitude 31° 22′ south, longitude 36° 39′ west, the water shoaled to 1,469 fathoms; and the next cast, taken in latitude found was 378 fathoms, in latitude 31° 02′ south, longitude 34° 27′ west."

This bank, which it is proposed to call Enterprise bank, extends about 150 miles in longitude.



DEEP-SEA SOUNDINGS IN THE ATLANTIC.

U.S.S. Enterprise, Commander A. S. Barker
U.S.S. Essex, Commander W. S. Schley
British ship Challenger, Commander G. S. Nares
German ship Gazelle, Capt. V. Schleinitz



PROFILE OF OCEAN-BED BETWEEN MONTEVIDEO AND THE CAPE OF GOOD HOPE AS SHOWN BY THE DEEP-SEA SOUNDINGS OF THE U.S.S. ENTERPRISE.

31° 15′ south, longitude 35° 42′ west, was only 547 fathoms. From this position casts were taken at intervals of five miles or thereabouts until over the shoalest part of the bank. The least depth It may be much shoaler in other places than those sounded over, as its extent in latitude is not known, and there have been no soundings in that neighborhood which will admit of any generaliza-

tions in regard to it. The hydrographic office will have it further examined at the first opportunity.

From this point the easterly course was continued until the line of soundings taken three years before by the Enterprise was crossed, in about latitude 27° south, longitude 27° west; and then the line ran almost directly for the Island of Fernando de Noronha, the depths averaging about 2,800 fathoms, until the vicinity of this island was shown by a sounding of 2,280 fathoms. Beyond, the depths increased to an average of about 2,500 fathoms until the neighborhood of Barbadoes was reached, when the water shoaled again to 1,204 fathoms.

The depth of 2,560 fathoms in longitude 55° west, latitude 12° north, is within thirty miles of a sounding of 2,570 fathoms taken by the U.S. brig Dolphin in 1852; that of 2,714 fathoms in latitude 11° 25′ north, longitude 52° 50′ west, is within thirty miles of a sounding of 2,780 fathoms, also taken by the Dolphin in 1852.

After leaving St. Thomas, sounding was again resumed; the first cast, taken in latitude 19° 53′ north, longitude 65° 45′ west, showing 4,529 fathoms. As this point is about forty miles east-northeast of the famous cast of 4,561 fathoms, made by Lieutenant-Commander Brownson, U.S.N., with the coast and geodetic survey steamer Blake, the great depth obtained is peculiarly interesting. Beyond this deep the line ran towards Cape Hatteras, over a section formerly unsounded, showing an average depth of about 3,000 fathoms.

Commander Barker further says, "A ship like the Enterprise can undoubtedly sound in any sea and in any weather in which she can steam ahead fast enough to stem the wind and steer. The brake used was a plain piece of rope made fast inboard of, and abreast of, the lower part of the reel, then around the groove outboard, and held in the hand above. This brake controls the reel perfectly, it being possible to hold the shot, without any effort, at a great depth. In rolling heavily it is very easy to keep a constant strain on the wire. A distance-line of at least 12 fathoms was used, with a piece of lead weighing about a pound near the grommet. One length of the large American wire was put on next to the distance-line, as it was not so likely to kink. To prevent the shot from catching on top of the cup, a tripping-line was used, consisting of a piece of small stuff, one end made fast to the rod just below and in the plane of the hook, and the other end around the top of the cup: this line is of such a length as to be taut when the cup is closed. In nearly all the casts, sail was made after reeling in to 2,000 fathoms, but only such as not to give a greater speed than four knots. When reeled in to 1,000 fathoms, all sail was made. The wind was always kept on the starboard side, so as to have the wire to windward. The only accident which happened on the trip was due to the wire catching some part of the ship, probably the propeller: it was dark at the time, and she was going at the rate of about seven knots." The accompanying chart shows the principal lines of deep-sea soundings south of latitude 40° north. The hydrographic office has in course of preparation a series of charts showing the contours of the ocean-beds as determined by all reliable soundings that have been taken.

J. R. Bartlett.

U. S. hydrographic office.

LONDON LETTER.

After more than seven years of investigation and experiment, the Royal commission appointed to inquire into accidents in mines has presented its final report, which was issued on Saturday in the form of one hundred and ten pages of a large blue-book. The delay is accounted for by the long and difficult quest on which the commissioners were sent. They were to report, not only on the causes of mining accidents, but also on "the possible means of preventing their recurrence, or limiting their disastrous consequences." Not much is recommended in the way of mere legislative changes, but the scientific recommendations are most interesting and important. For example: with reference to the difficult question of the best method of firing shots in mines, they state that "electrical exploding appliances present very important advantages from the point of view of safety, over any kind of fuze which has to be ignited by the application of flame to its exposed extremity, as the firing of shots by their means is not only accomplished out of contact with air, but is also under most complete control up to the moment of firing. Their simplicity and certainty of action has been much increased of late years, while their cost has been greatly reduced, and but little instruction is now needed to insure their efficient employment by persons of average intelligence. The use of electrical arrangements for firing shots in mines where the employment of powder for blasting is inadmissible should be encouraged as much as possible."

Again, they state that "it has been shown that mines which have hitherto been considered free from fire-damp may have the air which passes through them vitiated to an extent corresponding to about two per cent of its volume of marsh-gas. The air in many such mines may probably never be entirely free from explosive gas; at all events, in the neighborhood of freshly cut faces of coal

and in the return air-ways. It has been demonstrated in our experiments, that, when the atmosphere contains five to five and one-half per cent of marsh-gas, it becomes highly explosive. We have even obtained explosions which, though less violent, might be nevertheless destructive of life if they occurred, on the large scale possible in a mine, when the air contained only four per cent of marsh-gas. It will thus be seen that air which would appear free from gas if tested in the ordinary way, may become, by the addition of only about two per cent of marsh-gas, capable of propagating flame and causing destruction, while the addition of about three per cent converts it into a highly explosive mixture. Air which would appear quite free from gas if examined by a lamp-flame, may become explosive when laden with fine, dry coal-dust. Appliances now exist by which very small proportions of marsh-gas in air may be readily detected, and which can be used for examining the atmosphere of a mine. With Liveing's indicator, gas present in the air can be estimated with sufficient accuracy for all practical purposes, even when the proportion is as low as one-quarter per cent."

In connection with this subject, the suggestion, first due to Mr. Galloway, that coal-dust alone suspended in air might cause an explosion, is considered, and an account is given of some carefully devised experiments which rather tend to confirm this conclusion. The commissioners discuss with some detail the means of removing this dust, and devote a large section of the report to the question of the conditions under which blasting can be done in safety. Considerable space is devoted to safety-lamps, and it is pointed out how great an influence the velocity of the air-currents in the air-passages of a mine has on the safety of a lamp. The electric lamp is perhaps the chief hope of the miner, though it does not, like the safety-lamp, indicate the presence of gas. The commissioners arrived at the following conclusions: "that it is most important that all mines should be carefully examined by means of indicators capable of detecting as small a proportion as one per cent of gas; such examination to be made before the commencement of each day-shift, and, in case of an interval, also before the succeeding shift; and that in all dry mines where the air may be laden with coal-dust, and where fire-damp is either known to be given off from the strata, or may from experience be reasonably suspected to exist, the secretary of state may require safety-lamps to be used, unless the owners and workmen of such mines prove to the satisfaction of a court of arbitration, to be appointed by the respective parties, that less liability to accident generally will be involved by the working of the mine with open lights than by use of safety-lamps. It should be a special instruction to such court that the circumstances of each mine be taken into consideration."

The late Prof. John Morris, who died in January last, had been engaged for some time in preparing a third edition of his invaluable 'Catalogue of British fossils.' The first edition was published in 1843, and the second in 1854. From that date onwards, Professor Morris had been collecting materials for a third edition, which, unfortunately, he did not live to complete. But his manuscripts have been placed in the hands of a committee, which includes the keeper of the geological department in the Natural history museum, the president of the Geological society, and other well-known geologists. They have divided up the work among several specialists, who have engaged to finish their respective parts within six months; and it is therefore hoped that this great work may be completed before very long.

The publication of the Challenger volumes is now proceeding rapidly. No less than fourteen reports are at present passing through the press, and it is expected that the entire series will be completed by the end of next March.

The Lumleian lectures, now in course of delivery before the College of physicians by Dr. W. H. Stone, are attracting unusually large audiences. Their subject is 'The electrical conditions of the human body.' Dr. Stone was one of the first to call attention to the importance of determining accurately the physical constants of the agent electricity when employed in physiological investigation. In these lectures he has shown that most of the contradictory results obtained by the earlier investigators are due to the neglect of this precaution. The enormously high resistance of the epidermis was demonstrated; and, when this was eliminated, the average resistance to a continuous current from the ulna at the wrist to the malleolus at the ankle, was shown to be about 1,170 ohms, due allowance being made for the errors caused by polarization, according to the ingenious method first devised by Sir Henry Mance for the Persian Gulf cables. Some entirely new experiments were detailed, and in part repeated before the audience, showing that the human body could be charged and discharged like a secondary battery. An electromotive force of two volts was employed, and curves showing the rate of discharge were exhibited. A discharge current of sixty micro-ampères at first, under an electromotive force of about one volt,

sank to forty-eight in five minutes, and remained at that for some hours. The resistance offered by the body to an induced current was stated to be only half that offered to a continuous one. An ingenious speculation was hazarded as to the possibility of the human nervous system distantly resembling a duplexed telegraph-cable, in which a transmitted impulse is balanced and inhibited at the sending-station, but unbalanced and exhibited at the receiving-station. W.

London, April 18.

NOTES AND NEWS.

The following, in addition to those given in our last issue, completes the list of papers read at the National academy of sciences, April 20–23: Alfred M. Mayer, On the diathermancy of ebonite and obsidian, and on the production of calorescence by means of screens of ebonite and obsidian; On the coefficient of expansion of ebonite; On the determination of the cubical expansion of a solid by a method which does not require calibration of vessels, weighings, or linear measure; On measures of absolute radiation; E. D. Cope, On the geology of the region near Zacualtipan, Hidalgo, Mexico; Edward S. Morse, On ancient and modern methods of arrow release; Theo. Gill, The ordinal and super-ordinal groups of fishes; H. A. Rowland, On the absolute and relative wave-lengths of the lines of the solar spectrum; Wolcott Gibbs, Platinous compounds as additive molecules; Ira Remsen, Influence of magnetism on chemical action; A. Graham Bell, Upon the deaf and dumb of Martha's Vineyard (continuation of research relating to the ancestry of the deaf); S. P. Langley, On the invisible spectra; G. F. Becker, Cretaceous metamorphic rocks of California (by invitation); Ogden N. Rood, On color contrast; Charles D. Walcott, Classification of the Cambrian system of North America (by invitation); A. W. Wright, Crystallization of platinum by means of the electric discharge *in vacuo*; W. K. Brooks, The Stomatopoda of the Challenger collection; Budding in the Tunicata; A. W. Wright, Effect of magnetization on the electrical resistance of metals; R. E. Peary, U.S.N., On a proposed expedition into the interior of Greenland.

LETTERS TO THE EDITOR.

Science at Cornell.

My attention has been called to the communication signed 'H. N.' in *Science* for April 16, and I beg for a little space in which to point out one or two errors into which the writer has fallen.

I shall not attempt to deal with the swarming misstatements and exaggerations of the letter. These, although inviting game, are comparatively unimportant. But the fundamental idea of the writer is not without importance, and therefore should not pass unnoticed. That idea is divisible into two parts. The first is, that Cornell university, in developing its non-technical side, is doing violence to the fundamental law and charter of the institution: and the second is, that, in so doing, 'the successor of Andrew D. White' is reversing the traditions and former policy of the university. "Where," exclaims the writer, "are the traditions and the law and charter of Cornell?" Let us see.

First, The fundamental law declares its purpose in the words, "in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." To accomplish this declared purpose, which, it will be seen, is of the broadest possible character, the law required "the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts." How this shall be done is explained in the clause, "in such manner as the legislatures of the states shall respectively prescribe."

Here we see, in the language of the law itself, a purpose that is clearly unmistakable. It includes not simply agriculture and the mechanic arts, but 'other scientific and classical studies,' 'military tactics,' and 'the several pursuits and professions of life.' Furthermore, these provisions shall be carried out in such a way as the legislatures of the states may severally prescribe. So much for the fundamental law.

Second, The charter of the university, after repeating the provisions of the fundamental law, and doubtless in view of the very large gift of Mr. Cornell, adds the following sentence: "But such other branches of science and knowledge may be embraced in the plan of instruction and investigation, pertaining to the university, *as the trustees may deem useful and proper*." In other words, the trustees are left by the charter to determine precisely what branches of science and knowledge shall be embraced in the plan of instruction, after those specifically provided for have been established and duly equipped.

Third, Now as to traditions. As soon as the trustees named in the charter came together, the first thing to be done was to determine upon a plan of organization. A committee for that purpose was appointed, of which Andrew D. White was chairman. On the 21st of October, 1866, he presented his famous report. In the very first part of it, under the head of 'Fundamental plan of instruction,' he argues the very question which lies at the bottom of 'H. N.'s' grievance. He is of opinion that the fundamental law justifies the establishment of all the departments of a true university. But, even if it did not, he finds unmistakable warrant in the provisions of the charter. In order that there may be no possible misunderstanding of President White's views, I quote a single sentence from p. 4 of the report: "Even if it should be claimed that the whole effort of the trustees ought to be devoted to agriculture and the mechanic arts alone; even if we were to construe away the plain words of the original act of congress, which speaks of 'other scientific and classical branches' as part of the object of the government grant of lands, — still the oft-repeated declaration of our founder, that he 'wishes to make such provision that every person can find opportunity here to pursue any study he desires,' would be our

sufficient warrant in using at least his munificent gift in supplementing the special instruction with general instruction, and rounding it out into the proportions of a university."

Now, proceeding on this theory, under the head of 'Organization,' President White gives a list of the departments which he thinks ought to be established. Conspicuous in this list, on p. 5 of the report, is the department of medicine and surgery, and the department of law. Then on p. 13 of the same report I find, in the list of professors, the appointment of whom he recommends, — a 'professor of municipal law,' and a 'professor of constitutional law.' For the purposes of this presentation it is, of course, needless to speak of the other departments contemplated in the plan of organization.

Now, I have read all the speeches, and I believe all the reports, of President White; and I believe there is not a passage in one of them, from first to last, that contradicts, either in letter or in spirit, the doctrine here set forth. I will go further, and say that through them all is to be seen the same spirit as that manifested in the 'plan of organization.' This is my answer to 'H. N.'s' grandiloquent inquiry, "Where are the traditions and the law and charter of Cornell?"

It has never been claimed, and is not now claimed, that the technical departments are of secondary importance; but, as I asserted in my address at New York, I hold that these departments have now so far been provided for, that the time has arrived when attention should be called to the needs of other departments. I do not mean by this that the university is to cease its appropriations for the technical schools. So far as I know, it has no such intention. This, indeed, may fairly be inferred from the fact that at the present moment the trustees are taking steps for the immediate erection of an ample building for the veterinary department, and to add four rooms to the agricultural museum. We shall do still more in the same direction, but it is not the purpose of the trustees to limit the activities of the university to a single one of those interests, comtemplated at the time of its organization, and, indeed, throughout its history.

No revolution is taking place at Cornell. On the contrary, its trustees are trying to develop it strictly along the line of its fundamental law, its charter, and its traditions. Surely it is late in the day for this university to be turned from such a purpose by any hint that its charter is in danger.

C. K. ADAMS.

Cornell university, April 26.

Popular astronomy.

I think the author of the article 'Popular astronomy' (*Science*, April 23), in his chivalric defence of the rights of Professor Newcomb and myself, has really done a serious injustice to Dr. Ball in virtually charging him with deliberate plagiarism and "a continued effort to conceal the theft, which is petty in the extreme," by slight alterations of the borrowed material. No one personally acquainted with Dr. Ball could possibly suspect him of intentional wrong in the case: I believe him to be totally incapable of any thing dishonorable.

Judging from my own experience, which, though not extensive, has been exactly to the point, a very simple explanation will account for the apparent appropriation of other people's language, which is the foundation of the charge. In preparing for lectures to college classes and to popular audiences, I collect all the material I can find, and, in speaking, use it liberally. Of course, I indicate in a general way my obligations and sources of information; but it is quite impossible, while speaking, to point out every place where I am using language suggested by my reading. In fact, not having the matter written out, it is not possible (for me at least) to quote accurately the words of my authority; and, after a few repetitions of the lecture, the *quasi* quotations become modified by changes that make them conform to my usual forms of expression, and render them, so far as consciousness is concerned, quite as much my own as any other part of the lecture. At the same time they would be quite recognizable by one familiar with the original.

Now, in making a book upon the subject upon which one has been lecturing, he will inevitably write pretty nearly what he would say if standing before an audience, and in this way will quote, unconsciously and more or less inaccurately, passages of considerable length from the works he used in his original lecture-preparation. The only way I know of to do justice in the matter, is first to put into the preface of the book a full general acknowledgment of obligations, and then to go over the manuscript, lecture-notes in hand, hunting up and marking all these unconscious quotations, and restoring them to their original form.

Dr. Ball seems to have failed in doing this thoroughly, and hence, no doubt, the oversights which have led to the charge of guiltily disguised plagiarism. I am sure he meant no wrong, and I am greatly complimented and flattered by his approval and use of my work.

C. A. YOUNG.

Princeton, N.J., April 24.

As Sir Robert Ball is on the other side of the Atlantic, I deem it proper to say that he has satisfactorily explained the circumstances alluded to in the last number of *Science*. Although this explanation only refers to the copying of passages from my 'Popular astronomy,' I have no doubt that his remarks would apply equally to the close parallelism of passages in his book, and in Professor Young's treatise on the sun. His statement is as follows: —

"Your sketch of the discovery of the companion of Sirius I transcribed some years ago, before I had any thoughts of writing my book. The passage about Tycho I had, however, more recently taken. When I came to prepare the materials for the press, I lost sight, it seems, of the source of these passages, and treated them as if the language had been my own.

"Not until yesterday, when I read the review in the New York *Nation*, did I know that my book contained any passage virtually yours, except that duly acknowledged on p. 231."

I suppose this is an inadvertence of which any of us might be guilty who are in the habit of copying passages for use in popular lectures, or as memoranda for any other purpose.

S. NEWCOMB.

Arsenic in wall paper.

A note in *Science* (April 23, p. 371) says, "The investigation before the Massachusetts legislative committee on the subject of arsenic in wall-paper indi-

cates that the danger has been exaggerated." So far is this from being the case, and so great is the real danger, that I beg space for the presentation of some facts. The immediate cause of the present investigation was a letter published in the Boston *Herald* on Jan. 19, in which I gave a detailed account of sufferings in our own house due to arsenic in the wall-papers, and involving all the members of the household. Since that time many persons have published similar accounts in the Boston papers. Abstracts of twenty-two such letters appeared in the Boston *Advertiser* of March 2 and 12, fourteen of the same appearing in the Boston *Herald* of March 2; and in the four hearings given by the public health committee to the petitioners a mass of evidence was presented which must have convinced any unprejudiced mind. The committee have not yet made their report to the legislature, but it is expected that they will soon do so. The statement has already been published in the Boston papers, that the committee will recommend legislation, and it would be a matter of great surprise if they should do otherwise, — a surprise even to those who are trying to defeat legislation.

Science also adds, "Prof. C. F. Chandler testified, that, from careful experiments, under no conditions could arsenical poisoning occur through breathing arseniuretted hydrogen from wall-paper, and that the only source of danger would be from friction alone." In point of fact, Professor Chandler's testimony was much stronger than this. He not only stated that he believed the generation of arseniuretted hydrogen from arsenical wall-papers to be impossible, but he also said of this gas that he considered 'a small quantity comparatively harmless.' As to the legislation, for which those of us who have suffered were asking, he said that he was 'not in favor of any law on the subject;' that personally he was 'not afraid of arsenical wall-paper under any circumstances, with any quantity;' and that he considered the evidence of persons who suppose that they have suffered from wall-paper poison to be 'of very little value.' He also said that some years ago he investigated the whole subject of dangers from arsenical wall-papers, 'and concluded that there was nothing in it;' while his conviction that the generation of arseniuretted hydrogen from arsenical wall-papers is impossible was based on experiments made by two of his students in his laboratory six years ago.

As to all the essential points involved in the investigation, the petition is supported by the best chemical opinion in Harvard university, by some of the best medical opinion in Massachusetts, and by a body of evidence from actual sufferers unimpeachable and unanswerable. But I desire specially to call attention to the fact that Professor Chandler himself gives indirect support to the petition. As one of the original editors of Johnson's 'Universal cyclopaedia,' and one of the active editors in the revision now going through the press, Professor Chandler publishes in vol. i. (New York, 1886) an article on arsenious oxide, wherein he calls attention to the danger from arsenical paper. His language is, "Recent inquiry would lead to the belief that rooms covered with paper coated with this green arsenite of copper are detrimental to health, from the readiness with which minute particles of the poisonous pigment are detached from the walls by the slightest friction, are diffused through the room, and ultimately pass into the animal system. It is also said that arseniuretted hydrogen (H_3As), a very poisonous gas, is generated in damp weather."

True, this language was first written for an earlier edition; but inasmuch as no expense was spared in the revision (see publisher's announcement), and inasmuch as Professor Chandler was one of the revisers, the language may be taken as the utterance of all that Professor Chandler considered it worth while to say at the time when the new volume was published. I have called this article an '*indirect* support' to our petition, because, although the writer does not squarely state an opinion of his own, yet his language undoubtedly makes the impression that he considers the subject an important one,—one, indeed, which he has not investigated, and on which he therefore has not formed an opinion, but important enough to call attention to the danger.

It is also interesting to observe that one of the authorities whom Professor Chandler quotes against the theory that arseniuretted hydrogen escapes from arsenical wall-papers has subsequently changed his opinion. I refer to Watts's 'Dictionary of chemistry.' So far as I have been able to learn, the last expression of Dr. Watts on the subject in hand is found in the third supplement, which is vol. viii. of the whole work, in part i. p. 122 (London, 1879). There we read, "*Arsenic in the air of rooms.* — From experiments by H. Fleck (*Zeitschr. für biologie*, viii. 444), it appears that the air of rooms, the carpets or wall-papers of which are colored with Schweinfurth green, often contains arseniuretted hydrogen, produced by the action of moisture and organic matter on the arsenical pigment. The size, starch, paste, etc., used in hanging the paper, appear to be especially active in this respect."

Also another authority, whose opinion of 1862 Professor Chandler quotes against our petition, has long since given up that opinion. I refer to Dr. Hoffman of Berlin. Dr. Hoffman was one of the scientific men summoned a few years ago to aid the German royal sanitary commission in investigating the dangers from arsenic in objects of domestic use. Dr. Hoffman's present opinion is seen in the report of the commission, which resulted in a stringent law in Germany. The language bearing on this subject is as follows: "Wall-papers are deserving special attention, and also window-curtains, which frequently contain large amounts of arsenic. The injurious action of this is not only through the lading of the atmosphere with arsenical dust, but also from the continued formation of arseniuretted hydrogen, a gas extremely dangerous to health."

I am happy to state that the public health committee of the Massachusetts legislature have ordered the publication of the stenographic report of the hearings given on this subject, and this document cannot fail to be of value to the legislative committees of other states or of congress when the enormity of the arsenic evil shall become more widely known.

D. G. LYON.

Cambridge, Mass., April 24.

On two plates of stratigraphical sections of the Taconic ranges by Prof. James Hall.

In an article in the number for April, 1886, of *The American journal of science*, entitled 'On lower Silurian fossils from a limestone of the original Taconic of Emmons,' on p. 247, the author speaks of

a 'most welcome addition,' to the stratigraphy of the Taconic range, of two plates of stratigraphical sections' by Professor Hall, 'prepared by him forty to forty-five years since.'

Those two plates, or rather five plates, for that is their exact number, were freely distributed by Professor Hall as far back as Lyell's second visit to America, 1845–46, and are well known on both sides of the Atlantic.

Professor Emmons refers to them in one of his letters, dated Raleigh, N.C., Dec. 28, 1860, of which I published an extract in 'The Taconic system and its position in stratigraphic geology' (*Proc. Amer. acad. arts and sciences*, vol. xii. p. 128, Cambridge, 1885), as follows: "You are aware that [Professor] Hall prepared five long sheets of sections illustrating his views, and which extended from the Helderberg to the Connecticut River, and from the Lake Champlain to the Connecticut valley. . . . They were designed to sustain his peculiar views. I have copies, and I wish you had them. They are curiosities in their way."

It is evident that the views entertained by Professor Hall, contesting the conclusions of Dr. Emmons, have been placed before geologists in the United States, Canada, and Europe since the appearance of 'The Taconic system' in 1842.

JULES MARCOU.

Cambridge, Mass., April 23.

A carnivorous butterfly larva.

One of the most interesting of our butterflies is that known as Fenesica tarquinius, — a unique lycinid having the wings above brown-black in color, with conspicuous orange markings both on primaries and secondaries. It has a wide geographical range, occurring very generally over North America, as also in Asia.

Donovan, in his 'Insects of India' (pl. xliv. fig. 1), illustrates the butterfly rather poorly, but says nothing about the larva; Boisduval and LeConte (*Hist. des lep. et des chen. de l'Amer. Sept.*, p. 128, pl. 37) figure the larva, pupa, and imago under the name of Polyommatus crataegi, and simply quote Abbot as stating that the larva lives in several species of Crataegus; Scudder (*Proc. Essex inst.*, iii. p. 163, 1862) treats of it under the name of Polyommatus porsenna (*Syn. list of Amer. rurales*, Bull. Buff. soc. nat. hist., iii. p. 129, May, 1876), giving the food-plants of the larva as Alnus, Ribesia, Vaccinium, and Viburnum (later, in the *American naturalist* for August, 1869, he gives the food-plants as follows, — 'probably arrow-wood, elder, and hawthorn'); Grote (*Trans. Amer. ent. soc.*, ii. p. 307) first proposed the generic name of Fenesica, but says nothing about its larval history; Strecker (*Butt. and moths*, etc. — Diurnes, p. 103) repeats simply from Scudder; while William H. Edwards, in his admirable life-histories of butterflies, has not, so far, treated of this particular species. In short, so far as the published records go, it has been generally assumed that the larva feeds upon the plants named.

The object of this brief communication is to show that in this larva we have one that is truly carnivorous,—a fact which is extremely interesting, because, so far as I can find, there is not another recorded carnivorous butterfly larva; and Mr. Scudder, who has given great attention to the butterflies, writes me in a recent letter, in reply to an inquiry on this point, that he cannot recall any mention of such. Quite a number of heterocerous larvae are known to be carnivorous by exception, and not a few are so as a rule. These are chiefly found among pyralids; and it is not necessary, for my present purpose, to refer to the cases in detail.

For some years, now, I have been studying the remarkable life-habits of the Aphididae, and especially of some of the gall-making and leaf-curling species of Pemphiginae.

In collecting material and making observations, I have been assisted by Mr. Th. Pergande, who has, on a number of occasions since 1880, found the larva of this Fenesica associated with various plant-lice. Among the species with which it has been thus found associated are Pemphigus fraxinifolii Riley, which curls the leaves of Fraxinus; Schizoneura tessellata Fitch, which crowds upon the branches of Alnus; and Pemphigus imbricator Fitch, which congregates in large masses on Fagus. All these species produce much flocculent and saccharine matter.

The frequency with which this larva was found among these plant-lice justified the suspicion that it feeds upon them or derives benefit from them; yet up to 1885 the presumption was that it benefited from the secretions of the plant-lice rather than from the insects themselves. Last fall, however, Mr. Pergande obtained abundant evidence that the Fenesica larva actually feeds upon the aphidids, and I thought it worth while to call attention to this positive proof of the carnivorous habits of the species. That the different species of plant-lice are the normal food of this larva, is rendered more than probable for the following reasons: —

1. Attempts to feed the larva upon the leaves upon which it was found have proved futile, the larva perishing rather than feed upon them.

2. The food-plants given by the authorities are such as are well known to harbor plant-lice.

3. Mr. Scudder's authorities, as he informs me, were picked up here and there; and one of them for alder, which he recalls, 'found it more commonly on a limb among plant-lice.'

4. Mr. Otto Lugger has frequently observed the larva around Baltimore among Pemphigus imbricator on beech, but never disassociated from the lice; and Judge Lawrence Johnson also found it in connection with the same species around Shreveport, La., last fall, and surmised that it might feed upon the Pemphigus; but neither of these observers were able to get positive proof of the fact.

C. V. RILEY.

Combined aerial and aquatic respiration.

In investigating combined aerial and aquatic respiration in vertebrates, the following questions have presented themselves for solution, — questions which, so far as we have been able to ascertain, have not been previously answered by physiologists: —

1. Is the aerial part of the respiration like that of animals with an exclusively aerial respiration?

2. Is the aquatic part of the respiration like that of animals with an exclusively aquatic respiration?

In answer to these questions, we offer the following facts and conclusion: —

1. Observations upon the aquatic respiration of soft-shelled turtles (*Science*, vi. p. 255; and *Amer. nat.*, 1886, p. 233) showed that the air taken from the lungs of a turtle that had been immersed several hours, had been almost completely deprived of its

oxygen, while but a trace of carbon dioxide had been added to it. The water in which it had been immersed had received, however, a much greater amount of carbon dioxide than could have been formed from the free oxygen taken from the water.

2. Tadpoles were placed in a jar partly filled with water, and the jar hermetically closed. After several hours, the air was analyzed, and the free gases in the water determined. These determinations showed that nine tenths of the oxygen consumed came from the air, and one tenth from the water; while, of the carbon dioxide produced during the experiment, the air contained three tenths, and the water seven tenths.

In order that the carbon dioxide given off by the tadpoles to the air might not be absorbed by the water during the experiment, a layer of olive-oil six millimetres thick was put upon the water.

3. It was found by careful and repeated observations, under perfectly natural conditions, that frogs in cold weather (so-called 'winter frogs'), in water at 0° to 15° C., remain with their heads above the surface from one-tenth to one-half the time, and while above the surface carry on from eight to twenty lung respirations per minute; showing, that, under natural conditions, the respiration of 'winter frogs' is not entirely or almost entirely carried on aquatically by the skin, as is commonly supposed (Klug and Martin).

4. The results obtained by Moreau and others, upon the respiratory function of the air-bladder of ordinary fishes, and those of Wilder, on the respiration of Amia (the mud-fish), are in general accord with the facts stated for turtles and tadpoles.

These facts seem to us to justify the conclusion that the respiratory gas-interchange in combined aerial and aquatic respiration does not conform to the law governing either exclusively aerial or exclusively aquatic respiration, but that, whenever aerial and aquatic respirations are combined in an animal, the aerial part of the respiration is principally to supply oxygen, and the aquatic part to get rid of carbon dioxide. S. H. and S. P. GAGE.

Anat. lab., Cornell univ.,
April 15.

Pharyngeal respiratory movements of adult amphibia under water.

In studying adult amphibia for possible respiratory movements under water, we have found that the common newt (Diemictylus viridescens) so abundant in lakes and ponds, and which is known to remain voluntarily a long time under water, carries on, while under water, rhythmical pharyngeal movements almost precisely like those of the soft-shelled turtles; and, as in the turtles, these movements cause a flow of water into and out of the mouth and pharynx.

The Cryptobranchus (Menopoma) has also been found to draw water into the mouth, and to expel it, in part at least, through the persistent gill-fissures.

So far as we know, these facts have not been published before. We would be glad to know if these observations have been previously made on Diemictylus and Cryptobranchus, and if similar pharyngeal movements under water have been described for other adult amphibia. S. H. and S. P. GAGE.

Anat. lab., Cornell univ., April 25.

The germination of pond-lily seeds.

In the issue of *Science*, March 21, 1884, there appeared a conditional offer of seeds of the Nymphea odorata, obtained by me in the fall of 1883, the growth of that year. Many of the seeds at this time were germinating; some had developed the second leaf. There was a marked difference in color; the variations were, in shades of red, from blood-red to light pink, from dark blue-green to light yellow-green, and from a dark bronze to a light salmon. It seemed to me, with varying and suitable culture, new varieties might be obtained, as the seeds are not always to be had, and the method of germination is not a matter of every-day observation. A number of applications were received, but I have not heard from any one, of successful culture, nor whether all or any of the seeds germinated. A succession of germinations gave me new plants to take the place of those destroyed by Unios, ferments, or fungi. The seed were kept under water, on sand, exposed to a north light, or that reflected from the brick houses on the north side of the street, fifty feet distant.

In June, 1855, I removed from the water all light seed, and those that were softened, as well as all on which fungoid growths had appeared, and placed the vessel in an open space where it had vertical light, and from the sun, for an hour between eleven and twelve in the morning in clear weather. A half-dozen new plants appeared in August, as the result of the change. When the cold weather came in the fall, I restored them to their old position in the north light, slightly obscured by ferns, Zygodium scandens and Pteris serrulata. About last Christmas I observed a new plant that had germinated since being brought in in the fall. This plant was removed to some submerged soil in another vessel, where it is now putting forth its fourth leaf. In February another seed germinated; and, since the 20th of March, three others have begun to grow. The last one was observed on the 3d of April. There are a few more very heavy seed in the water. The first plants from these seed that germinated early in 1884 — beginning in January — were peculiar in the length of the internodes, all being very long, some over an inch; and the seeds, before germination, were very light, and quite variable in color, but not as much so as the foliage.

The germinations of 1885 have shorter internodes, smaller leaves, of an even green color, whilst other germinations of this year have the internode reduced to a minimum; the leaves seem to start from the very dense and dark seed; and the foliage is variable in size and color, but mostly in light shades of bronze — salmon — with shades of pink.

The seeds varied in their development when taken from the pond in which they grew.

Some of the plants had just begun to coil the flower-stem by which to draw the seed down to the bottom of the pond; one had finished coiling, and the seed-vessel was in the mud; others were midway between these extremes. I mention this to show that there were natural and well-known causes for the variance in time of germination.

When it is known that the ripe and fully matured seeds are very dense, it will not seem so strange, that, considering the great number of seeds to a single flower, all ponds are not overcrowded, as by their density they sink into the ooze and remain dormant.

I shall note with interest any future germinations as lengthening the possible dormant period of these seed.

On April 19 I observed five more germinations, with the characteristics of those mentioned as growing this year. Up to April 24, three other young plants had started, making thirteen since Christmas; and these are as vigorous as those that started in 1884,— much more so than the growth of the summer of 1885. GEO. F. WATERS.

8 Beacon Street, Boston, Mass.,
April 24.

Eskimo building-snow.

In *Science* for April 23, 1886 (p. 372), Sergt. T. W. Sherwood has an inquiry about a certain formation of snow. I refer you to a paragraph in *Science* for April 25, 1884, p. 822, concerning 'ice-banners,' from observations of my own.

GILBERT THOMPSON.

U. S. geol. surv., April 23.

Certain homologous muscles.

The writer, having devoted some time of late to a comparative study of the myology of American mammals, has noted several interesting facts, to one of which attention is here asked.

The myology of the shoulder is, perhaps, more interesting than that of any other region, inasmuch as the variations in structure can usually be readily correlated with corresponding variations in habit. This is true in particular when applied to those changes observed in members of the same genus and family. In a forthcoming work I hope to present a mass of details illustrating the nature of these variations.

The muscular system is so plastic, and so immediate an expression of function, that it was hardly expected that many hints bearing on phylogeny could be derived from that source. Osteology, possessing as it does so many advantages in this respect, has been trusted far too exclusively, as I hope to show: at least, a careful study of the anatomy of the soft parts may be expected to furnish much confirmatory evidence. In the case of the shoulder, the omo-hyoid muscle may be said to furnish a valuable criterion by which to determine the primitive character of a species. Its presence in the archaic types, and frequent absence in specialized forms, can hardly be correlated with change in function.

The sciurimorphs are a very compact group, and yet present a great variety of modifications in adaptation to variation in habit. Among the members of the group found in the United States, the woodchuck (Arctomys monax) is perhaps entitled to rank as the most primitive form. This conception is suggested by the osseous structure, and finds an interesting support in a number of points in the myology, only two of which are here mentioned. The omo-hyoid passing from the sterno-hyoid to the anterior margin of the clavicle is very well developed. A very important part of the skin-muscle forming the covering of the cheek is derived from a broad, flat band springing from the anterior third of the sternum, the insertion being in the skin of the lips and chin. But most curious of all is the presence of a well-developed skin-muscle springing from the lower posterior free margin of the rhomboideus dorsalis, which, unlike the cucullarius, has an origin far down the back, overlapping the latissimus. The thin band of which mention is made is entirely distinct from any portion of the paniculus until it reaches the region of the cheek, where its fibres appear to lose themselves upon the skin. What gives these points interest is the fact that the only other rodent yet encountered, which has such a muscle, is Geomys, the pouched gopher. In G. bursarius an exactly similar muscle springs from the latissimus at almost the identical point, and has exactly the same course, its insertion being on the pouch, whence I have elsewhere termed it retractor bursae.

In none of the myomorphs examined has such a muscle been encountered. Without going into further detail, it will be sufficient to point out the fact that there may here be a hint of the antiquity, if not consanguinity, of these types, unless, indeed, it can be shown that an underground habit has developed in one case, — that which has its apparent explanation in the function dependent on the possession of a pouch in the other.

In the chipmunk, which is pouched, though only imperfectly fossorial and more perfectly sciurine, this muscle is absent. The spermophiles, although the nearest living American allies of Arctomys, do not possess this muscle. In the flying squirrel there is a thin band of muscle passing from the wrist, having its origin on the carpus opposite the volar spur, and passing to the same point as the muscle here described. The flying-squirrel also has a distinct omo-hyoid. C. L. HERRICK.

Dennison university, April 12.

A means of distinguishing the Canada lynx from the Bay lynx.

If a dozen zoölogists were asked how many species of lynx exist, the majority would probably decline to commit themselves to any opinion, while among the rest would be found advocates for a varying number of species, — as few as one, perhaps, or as many as eight or nine.

While examining a series of sixty or seventy skulls of American lynxes recently, I hit upon two characters which will, I believe, prove useful in distinguishing between the species more satisfactorily than has been possible hitherto. I found that in all the skulls from far north, indeed in all that were labelled 'L. canadensis,' the anterior condyloid foramen is large, looks downward, and is *not* confluent with the foramen lacerum posterium; and that the visible portion of the presphenoid is flask-shaped, the convexity being in front. In all the skulls of L. rufus, maculatus, and fasciatus, on the contrary, the two foramina are confluent, as in the cats generally, and the visible portion of the presphenoid is sagittate or linear.

The single skull of Lynx borealis in the national collection, and one of L. cervaria, exhibit the characteristics of L. canadensis.

It would appear that in the case of the American lynxes we are dealing with two distinct species only: 1°, L. canadensis; and, 2°, L. rufus, with its varieties fasciatus and maculatus. It is also probable that the confluence of the condyloid and lacerated foramina cannot hereafter be regarded as a distinguishing character of the Aeluroidea.

FREDERICK TRUE.

Washington, April 20.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 30, 1886.

MULTIPLE PERSONALITY.

AMONG the most interesting of the cases, says the *Spectator*, on which the Society for psychical research has recently centred the thoughts of investigators, is one of a patient who is called 'Louis V.,' and who was born in 1863. He is said, in the summary of his case, as given by Dr. Myers, and commented upon before the society by Mr. F. W. H. Myers, to have six different states of consciousness, all of them more or less accompanied by distinct physical conditions; but only in one of these six states is his memory something like that of an ordinary man; that is, able to recall the larger number of the various phases through which his life has passed. Even in this sixth state there are a few blanks in his memory; but in all the others he appears to remember only a few discontinuous portions of his history, and to forget completely those years in which his physical state was quite different from that in which he then finds himself. Thus, when he has paralysis of the right side (which is connected with a morbid condition of the left side of the brain), nearly twenty-one years of his twenty-three years of life are entirely wiped out for him. But even then a certain application of soft iron to his right thigh restores to him the memory of the greater part of his life, dispels temporarily all paralysis, and leaves only a few comparatively small gaps in his memory of his career. Again, under certain magnetic conditions, the hysterical paralysis — for the origin of the whole complaint seems to be a kind of hysteria — can be transferred from the right side (which involves a morbid condition of the left brain) to the left side, involving the same inertia of the right side of the brain; and this change, which is quite sudden, is accompanied by a very curious change in the apparent aspect of his character. From being arrogant, violent, and profane, with indistinct utterance and complete inability to write (owing to the paralysis of the right hand), 'Louis V.' becomes instantaneously quiet, modest, and respectful, speaking easily and clearly, and able to write a fair hand; but the greater part of his life is still a blank to him.

In a word, the change from 'Louis V.' with paralysis of the right side, to 'Louis V.' with paralysis of the left side, is not very different from the change which Mr. Louis Stevenson has described in the weird tale called 'The strange story of Dr. Jekyl and Mr. Hyde,' when Mr. Hyde is suddenly transformed into Dr. Jekyl — except, of course, that there is no alteration in the general bulk or stature of the body. The hysterical paralysis of the right side (involving the opposite side of the brain) leaves him a rude, presumptuous, illiterate boor; while the paralysis of the left side (involving the right side of the brain) finds him a docile, respectful, educated young man. The other five states of consciousness — induced by different physical means, though in some cases, indeed, not by physical means at all, but merely by authoritatively telling the young man that he is in one of his other states — are more or less intermediate between these two; and in one of them (the sixth as described) the man's character, though not apparently so good as in his best state (when the left side of the brain, the side supposed to be most frequently exerted in thinking and speaking, is active, and the right side is passive), is much better than in his worst, while his memory commands the greater part of his life, and the paralysis vanishes altogether. But in this state, apparently, it is not possible to keep him long, for his normal condition is at present that in which he forgets all the best part of his life, and is violent, arrogant, and profane.

Now, Mr. Myers apparently desired to persuade the Society for psychical research, of which he is one of the pillars, that this case points to a double personality in each of us, — one represented by the predominant activity of the left side of the brain, the ordinary personality; while the other, occasionally manifested in dreams or abnormal conditions of any kind, represents, for any one in whom it is manifested, what Mr. Hyde was to Dr. Jekyl, the more savage and brutal side of the man, the coarser, more vulgar, unreflective, overbearing side. And he even goes so far as to suggest that the activity of each separate side of the brain represents the command of a quite different sphere of knowledge; so that a man whose right brain is suddenly called into activity, while his left brain is lulled to sleep, may manifest not only a quite different character from his ordinary character, but also a quite different range of positive knowledge. In Mr. Myers's belief, the ruder character, which is best manifested by the activity of the right hemisphere of the brain, may yet have an instinctive insight to which the more nor-

mal and better disciplined character which uses most easily the left hemisphere of the brain is a stranger; so that, in a sense very different from that of the original saying, the left hand does not indeed know what the right hand doeth. If there be any truth in this theory, it must certainly be extended. In the case of 'Louis V.,' there appear to be no less than six different conditions of consciousness, in each one of which there must be some different proportion between the activity of the right and left brain. It is not merely a case of right brain *v.* left, but of various proportions of activity, — say, all right and no left, three-quarters right and one-quarter left, half right and half left, one-quarter right and three-quarters left, no right and all left, and lastly, perhaps, the equal co-operation of right and left. To each of these conditions a different personality would correspond; so that 'Louis V.,' instead of being two different persons in turns, is, perhaps, six different persons in turns, according to the variety of the mixture.

Of course, if this were an adequate explanation of the case, the application of a bar of steel to one arm, or of soft iron to the right thigh, would change one person into another person; or, in other words, personality would express nothing more than certain temporary phenomena, which, by the use of either physical or moral agencies, you could transform at will, if not into their opposites, at least into qualities as different as arrogance from modesty, or irritability from patience. We say 'by either physical or moral agencies,' because, as we have already said, it did not necessarily take any magnetic influence to produce the change: the change was also effected by simply assuring the young man that he was once more what he had once been, even though he had then absolutely forgotten this antecedent condition of his own consciousness; and with the belief, the physical state of the body as regarded paralysis or activity, itself changed; that is, as amongst his various selves, you could determine for him which of them he should be.

But what does all this prove? It proves not in any sense multiple identity, but what we have all of us always known, — that a man may easily lose the conscious clew which connects one phase of his life with another phase. We all lose, and lose for the most part completely, the clew connecting infancy with childhood. The very aged often lose, and sometimes completely lose, the clew connecting manhood and age. Even in the fulness of our strength, illness often wipes out of our memory a certain limited term of weeks or months. But then, it will be said, a man seldom or never loses the connecting-link of character. A selfish and irritable man is selfish and irritable throughout all his phases; a self-forgetful and patient man is self-forgetful and patient throughout all his phases; whereas, in this case of 'Louis V.,' we have a man transformed, in the twinkling of an eye, from an arrogant and ignorant boaster, into a quiet and docile learner. Does not that imply more than a change of memory or mental scenery? Does it not imply a change in the attitude of the will? Is it conceivable that a will trained to defer to the lessons of higher minds in one state, should lose all the training it had acquired, even though it had lost the memory of all who had given that training? If humility and arrogance are qualities only superficially distinct, and really severed from each other only by the memory or oblivion of a year or two of personal training, they are not moral qualities at all. Unless through every change of circumstances the thread of personality is continuous, personality is an illusion; and if it is continuous, then nothing can charm away a quality of the will, once genuinely acquired, unless it be the voluntary treachery and default of the will itself. If the left brain is a 'new creature,' but the right brain is unregenerate, then the two brains are not brains of the same person, and one of those persons is not responsible for the other person.

But the truth is, that nothing of this kind is even rendered plausible as an hypothesis by the cases of alternating consciousness of which morbid pathology treats. We might almost as seriously treat the healthy man as responsible for his delirious ravings in fever, as treat one of these hysteric patients as responsible for what he thinks and does under hysterical conditions. Grant, if there be evidence for it, that the abnormal activity of the right hemisphere of the brain implies the activity of the lower nature. If that activity be caused by disease alone, the patient is not responsible; but we all know that the activity of the lower nature may be caused, not by disease alone, but by either the application of a stimulus which we know we could withhold, or the neglect of a self-restraint which we know we could exercise. The attempt to draw inferences as to our normal and healthy state from the consideration of abnormal and unhealthy states, is a radically misleading one. All double or multiple identities are signs of disease. And, of all mistakes in psychology, perhaps the worst is that which takes its standard of health from the study of disease, instead of taking the cue for the healing of disease from the study of health. One essential note of mental health is a strong personal identity. A certain sign of disease is that hysterical multiplicity of states which presents its most typical

forms either in the rapidly changing phantasmagoria of delirium, or in the multiple vision of an over-stimulated brain. Exactly that which is chiefly conspicuous by its absence or its attenuation in all forms of hysteric disease, is personal identity, of which some of the pillars of the 'Society for psychical research' mistakenly hope to find the secret by studying the cases of those who pass their lives in disordered dreams.

SOME REMARKABLE GEMS.[1]

A FEW remarkable gems have been recently purchased by private buyers in the United States. One of these is a chrysoberyl cat's-eye weighing

FIG. 1.

$80\frac{3}{4}$ carats. Its dimensions are 23 mm. long, 23 mm. wide, and 17 mm. thick. The color, which is very even, is a superb brownish golden yellow, and the line is as even and distinct as is possible in a gem of such size. The cat's-eye hitherto awarded the palm is part of the 'Hope collection' included in the Townshend bequest to the South Kensington museum (fig. 2). This famous gem

FIG. 2.

measures 35.5 by 35 mm. in its true dimensions (the Hope catalogue gives the length as two inches, but this is only the case when measured over the dome). It formed part of the crown jewels taken from the King of Kandy in 1815. The crystalline markings are so arranged that the lower half shows an altar surmounted by a torch. The line is not straight, but inclined about 15 degrees. The color is dark, and the line is not so strongly marked as it should be in a fine gem.

Two of the largest known Ceylonese Alexandrites are to be noted. One of these weighs 28 23-32 carats, and its dimensions are 32 mm. by 16 mm. by 9 mm. In daylight its fine rich green color is tinged with red, but by gaslight it is a rich columbine-red, and scarcely to be distinguished from a Siamese purplish-red spinel. The other stone is the largest on record (fig. 3). It weighs

FIG. 3.

$63\frac{5}{8}$ carats, and measures 33 mm. by 32 mm. by 15 mm. It has a yellow grass-green color by daylight, but changes to a raspberry-red by artificial light.

The finest cut beryl (aquamarine) ever found in the United States is from Stoneham, Me. (fig. 4).

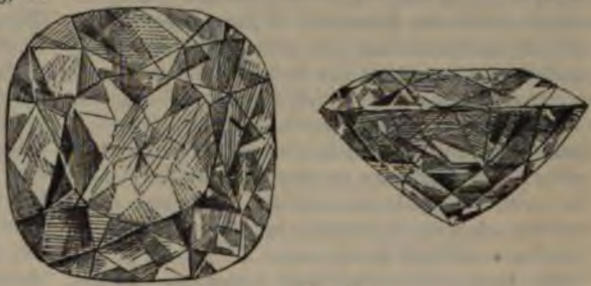


FIG. 4.

It measures 35 mm. by 35 mm. by 20 mm. It is a magnificent brilliant-cut, and weighs $133\frac{3}{4}$ carats. The color is a rich bluish-green, and, with the exception of a few minute hair-like internal striations, is perfect.

A ruby cut *en cabochon* is exhibited from Franklin, Macon county, N.C., showing somewhat the asteria effect. It is of good normal color, and quite free from flaws. Its dimensions are 5.5 mm. by 4 mm., and its weight 1 1-16 carats.

GEORGE F. KUNZ.

[1] From the Transactions of the New York academy of sciences, vol. v. No. 6.

RACE AND LANGUAGE.

THAT the character of a people, like that of individuals, is indicated by their speech, is a common observation. We all understand that the French, the German, and the Italian languages have a certain consonance with the mental traits of the nations that speak those tongues; and this fact may reasonably lead to certain inquiries.

Why is it natural to Frenchmen, Germans, and Italians, to Malays, Mongols, Arabs, Azteks, and Zulus, to talk in a certain way? What is the origin of those traits of character which develop themselves in these different modes of speech? And what are the laws which govern this development? Speech, like every thing else, is subject to laws: and as zoölogists know, from the fossil skeleton of some mammal of the tertiary era, the kind of life which the creature led, and the food that it ate, so a philologist ought to be able to judge, from the vocabulary and grammar of an extinct language, what sort of people were those who spoke it.

The question is one of great interest to anthropologists as well as to philologists; yet it seems to have attracted, until now, comparatively little attention. An English — or, rather, if we must make the 'home-rule' distinction which he would perhaps disdain, an Irish — scholar has just given to the world an elaborate work, in which he has endeavored, with much philosophical acumen and a careful analysis of many languages, to solve this important problem, and to establish the principles which govern the formation of languages.[1] The epithet 'epoch-making' has been somewhat freely applied of late years; but it is not too much to say that the work to which the learned dean of Clonfert has evidently devoted many years of assiduous study and much profound thought will make a new departure in ethnological science, so far as this depends on language. So much may be affirmed, without adopting in all cases the views which are set forth in his work.

Mr. Byrne finds the most important quality which influences the structure of a language to be the greater or less degree of mental excitability in the people who speak it. His arguments on this point are ingenious and forcible, and his main example is a striking one. According to the greater or less persistency with which the thought of the speaker dwells on his subject will be the tendency to compactness or looseness in the framework of his speech. The aborigines of Africa and those of America offer a notable contrast in this respect, and the contrast is faithfully reproduced in their language. The slow, cautious, considerate Indian temperament is shown in the polysynthetic — or, as Mr. Byrne prefers to style it, the 'megasynthetic' — character of the Indian languages, tending to combine many circumstances and qualifications in a single long and many-jointed word. On the other hand, however, the African quickness of thought, and lightness of mood, are displayed in the brief fragmentary words, and loose, disjointed phrases, which compose the ordinary speech of the tribes of that continent. Many examples are given in illustration of these opposite characteristics, both of mind and of speech, and the author may be fairly said to have proved his thesis.

He is not content with establishing the fact of this difference of character, and tracing to it the difference in the style of language. His next inquiry relates to the causes in which this difference of character originates. These causes he has no difficulty in finding in the different influences to which the inhabitants of the two continents are exposed. America lies, for the most part, in the temperate zones; and the portions which are within the tropics are either elevated into rugged tablelands, or covered, as in Brazil, with dense forests. The life of the people is almost everywhere one of hardship and anxiety, — the life of hunters, fishermen, and agriculturists, — requiring constant toil and watchfulness. In Africa, mainly a tropical country, the bountiful soil and genial climate make subsistence easy, and tend to produce in the people an impulsive and thoughtless character.

The author seeks to trace the operation of these and similar influences in the formation of the best-known languages in all parts of the globe. He submits each idiom to a minute scrutiny, and endeavors to point out the part which the habits of the speakers, and the natural influences that surround them, have had in producing their peculiarities of speech. If in any instances he has been unsuccessful, it is apparently because he has not sufficiently adhered to his own method, and has failed to take into account all the qualities of the human mind which would affect the language. An instance of this failure may perhaps be found in his attempt to account for the fact that in some languages the adjective precedes, and in others follows, its substantive. This difference in arrangement proceeds, he thinks, from the more or less careful attention which the communities who speak the languages are accustomed to give to the nature of substantive objects. But what reason is there for thinking that the Algonkin Indians, in whose speech the adjective precedes the substantive, pay more attention to the nature of things than the Iroquois, who place the adjective last, but are nevertheless, to all appearances, the more careful and industrious race? Can it be said that the artistic Italians, in whose language the adjective usually follows the noun, think less of the nature and qualities of things than do the Magyars, who place the adjective first? The true solution of this question seems to be found in the

[1] *General principles of the structure of language.* By James Byrne, M.A., dean of Clonfert. In 2 vols. London, *Trübner*, 1885. 8°.

influence of a powerful faculty which the author has omitted, in this and other cases, to take sufficiently into account, — the faculty of imagination. The English language teaches us a lesson on this special point. In ordinary speech the adjective precedes its substantive; but the moment the language rises into poetry, the order tends to be reversed; and the higher the imagination, the stronger this tendency appears.

Thus we have in Byron —

> "Adieu, adieu! My native shore
> Fades o'er the waters *blue*."

And in Scott —

> "Announced by prophet *sooth* and *old*,
> Doomed doubtless for achievement *bold*."

And still more strikingly in Milton's picturesque epithets —

> "Meadows *trim*, and daisies *pied*,
> Shallow brooks, and rivers *wide*."

We can understand how a vivid fancy may bring the object itself first before the mental vision, and that a momentary delay may be needed to discriminate and express its most striking qualities. There is no question, also, that the Iroquois, like the Italians, are a highly imaginative people, much given, as the reports of their councils show, to poetical improvisations. And finally, if we are to inquire to what influences both Italians and Iroquois owe their imaginative powers, we may perhaps find them in what Buckle would have called the 'aspects of nature,'— the mountains, rivers, forests, and seas which surround them.

Mr. Byrne is of opinion that the 'inflected' idioms — a class which he restricts to the Indo-European and Semitic tongues — indicate the highest grade of intellect in their speakers. Our pride of race would lead us blushingly to accept this compliment, until we find that we must share it with various barbarous septs, whom this pride of race would look down upon. Mr. Byrne, like other European scholars, — who cannot be altogether acquitted of race-prejudice in this respect,— has overlooked the fact that among the aboriginal tribes of America are several whose languages are as clearly inflective as the Greek or Arabic. Thus in Zeisberger's 'Delaware grammar' we find, as derivatives of *luen* ('to say'), *n'dellan* ('I say to thee'), *lellane* ('if I say to thee'), *lake* ('if I say to him'), and, in the imperative, *ill* ('say thou'), *luel* ('say on'), *lil* ('say to me'), *lo* ('say to him'), and the like. Pages might be filled with such examples of simple inflection, which, while they show clearly enough the polysynthetic cast of the language, have no more trace of the agglutinative cast than is to be found in any language of Europe. Duponceau, who translated this grammar sixty years ago, remarked, in reference to the views which had been expressed on the subject by Baron William von Humboldt, "The learned baron will, I hope, recognize in the conjugations of the Delaware verbs those inflected forms which he justly admires; and he will find that the process which he is pleased to call 'agglutination' is not the only one which our Indians employ in the combination of their ideas and the formation of their words." The Delaware is not alone. On the other side of the continent, in the languages of Oregon, pure inflections abound. Thus the Sahaptin, as is shown in the excellent grammar of the Rev. A. B. Smith, has the substantive verb, *hiwash* ('to be'), — used, it may be remarked, exactly like our own substantive verb, — which in the 'remote past' tense makes *waka* (*a* as in 'father'), 'I was,' and in the 'recent past,' *wáka* (*á* as in 'wall'), 'I have just been;' the only difference being in the change of the vowel-sound, precisely as in a Semitic conjugation.

What, then, shall we say? Shall we refuse to accept inflections as a proof of mental power? Or shall we more generously — and perhaps more scientifically — admit that they prove the barbarous speakers of these inflected American tongues to be equal in natural capacity to our own barbarous ancestors, the gifted inventors of the Aryan speech?

In spite, however, of such minor oversights, Mr. Byrne's work must be pronounced one of the most important and valuable among recent contributions to linguistic and ethnological science. The correctness of its main principles cannot reasonably be questioned; and the amount of information which the author has brought together and happily condensed, respecting a vast variety of languages spoken in every quarter of the globe, will make his treatise a treasury of reference for philologists. H. HALE.

THEORETICAL OPTICS.

THE wave theory of light was so firmly established by the labors of Fresnel from 1815 to 1827, that but few leaders in physical science continued to defend the Newtonian theory after that time. The only logical objection to the undulatory theory was its supposed incapacity to explain the phenomenon of dispersion, although Fresnel had, with an acuteness almost peculiar to himself, suggested, as early as 1822, that this might find its explanation in the fact that the molecules of a transparent substance are not separated by

Theoretische optik gegründet auf das Bessel-Sellmeier'sche princip. Zugleich mit den experimentellen belegen. Von Dr. E. KETTELER. Braunschweig, *Vieweg*, 1885. 8°.

intervals indefinitely small compared to a wave-length of light. This suggestion was worked out by Cauchy between 1830 and 1835, and for a long time was supposed to complete the undulatory theory of light. But during the last few years the theory has undergone a very active critical revision by physicists, prompted by two capital discoveries; namely, the extraordinary relations between the electrical and optical properties of bodies, and the anomalous dispersion of light. Students of physics are well aware that these two discoveries are prompting rapid developments in two distinct lines, — the electro-magnetic and the molecular theories of light.

This book by Dr. Ketteler is a very important contribution to the subject from the stand-point of molecular dynamics, the problems proposed and solved being much the same as those treated by Sir William Thomson in his lectures at Baltimore in 1884. Starting with Sellmeier's paper of 1872, on anomalous dispersion (which establishes certain differential equations closely allied to Bessel's differential equation of the motion of a pendulum in air), the author passes in review the theories of Helmholtz, Meyer, and Lommel, and then develops his own, which differs from the others in its assumptions as to the nature of the reaction of the molecules of matter upon the ether. It is well known that the essential feature of these theories is that the molecules of gross matter have, in general, definite periods of vibration comparable to the periods of light waves, and also (since Sellmeier) that they are subject to a 'damping' effect. As in this treatment the absorption of the medium becomes of equal physical importance with its refractive power, Ketteler proposes to define as the law of dispersion the equation containing complex variables, expressing both the curve of refraction and the curve of absorption.

With this basis, the author derives a law of refraction for transparent bodies and those having a single symmetrical absorption band, which contains only four constants, and which satisfies observations remarkably well. Even for the flint glass for which Langley has given indices corresponding to wave-lengths from 2.36 to 0.34 (i.e., for relative wave-lengths varying from one to seven), the formula seems to be wholly adequate. This must certainly be regarded as a remarkable feat; but, as the author concludes (p. 445) that he has accounted for all the phenomena of light except phosphorescence and fluorescence, this alone does not establish the claim of the book to unqualified praise. It is true that his treatment leads to the accepted solutions of Fresnel for the phenomena of reflection, refraction, and double refraction; but whether the processes are strictly legitimate may perhaps rest under some suspicion, in view of the fact that no one, before him at least, has succeeded in establishing a satisfactory theory for all of these phenomena on the basis of molecular dynamics. Even Sir William Thomson, in the Baltimore lectures, who approaches the problems from a stand-point not unlike that of Ketteler, except that he dispenses with terms involving viscosity as unphilosophical, emphasizes the statement that double refraction does not yield to the method.

It is a curiosity worth noting, that the author's theory explains the enormous dispersion of bisulphide of carbon, not by the great 'dispersive power' as defined by the second constant in Cauchy's equation, but by the exceptionally great wave-length of its absorption band, which is calculated as equal to 0.220.

The discussion of the electro-magnetic theory of light is suggestive, and, did it not demand too much space, some of it might well be quoted. This closes the first part of the book. The second part, of about two hundred pages, is devoted to the discussion of the author's experiments to test his theories: they, of course, largely relate to the phenomena of anomalous dispersion.

THE ROTIFERA.

WE have the pleasure of reviewing a very excellent work, which will be as welcome to the amateur and microscopist as serviceable to the professional zoölogist; for, to judge by the two parts already issued, the monograph of the Rotifera, by Mr. Hudson and Mr. Gosse, will be excellent throughout. The work is to be in two volumes of three parts each, with over thirty double plates, of which nearly all are to be colored. Its aim is to monograph the known species of the class, giving an improved classification, and including such anatomical observations as can be made upon the living specimens.

In accordance with this aim, the first chapter is an outline of the anatomy of the group Brachionus rubens, serving as type of the class; the descriptions, which are clear, being helped out by a plate of fairly good anatomical figures. The chapter is satisfactory, except that Mr. Hudson has indulged in the freak of describing the excretory apparatus, or, as it is often called in view of its homologies, the segmental organs, under the head of 'vascular system.' This is the same surprise to us that it would be to find the kidney

The Rotifera; or, Wheel animalcules. By C. T. HUDSON, assisted by P. H. GOSSE, F.R.S. Parts I. and II. London, *Longmans*, 1885. 8°.

described under circulatory organs. Perhaps the author meant only that the excretory organ consists of branching tubes or vessels, and is vascular, according to the etymological, though not to the technical, meaning of the word. Odd, too, is his designation of the ciliated funnels as 'vibratile tags.'

Chapter ii. gives a succinct, well-prepared and instructive history of the literature of the subject. Chapter iii. discusses the classification, and, after reviewing the previous systems, advocates a new one, which is more convenient than its predecessors, but, like them, artificial and arbitrary. The new system may stand for the present, but only as a convenient makeshift, pending the establishment of the permanent and natural classification upon a true morphological basis. Chapter iv. is devoted to sketchy notes on the haunts and habits. It concludes the first part.

The second part is entirely concerned with the monograph proper, and deals with the Flosculariadae and Melicertidae. The British species are figured and described with considerable detail, and several new ones are added. Concerning most of them numerous and valuable observations on the anatomy are also recorded, both in word and picture; for the authors have embodied results from their own original investigations so largely as to give their work importance as a contribution to zoölogical knowledge. The foreign species are also described, and in most cases figures of them are reproduced. It results that an urgent need is well met, for it is about quarter of a century since the last general revision of the rotifers was published in Pritchard's 'Infusoria.'

The plates have the figures on quite a large scale, and are partly colored. The drawings represent characteristic appearances, and are instructive. The lithographer has done his work quite, though hardly very, well. The printing of the text is good, and several fonts are so employed as to essentially facilitate the consultation of the pages.

To still further characterize the work, it must be added that the style is simple, direct, and of a distinctively literary quality. It is pleasant to reflect that most English scientific writers avoid both the pompous prolixity of the French and the uncouth cumbrousness of the Germans.

The morphologist will miss much from Hudson and Gosse's treatise, for it is essentially descriptive even when it touches upon anatomical matters. We have found no indication that the authors have considered the affinities of rotifers, nor the remarkable demonstration by Hatschek of the fact that they are the living representatives of the ancestral form common to worms, mollusks, and bryozoans, — the ancestral form which is still preserved to us in veligers, Lovên's larvae, etc. There can be little question that nearly all bilateral animals, except the Echinodermata, are derived from rotifer-like ancestors. It is this conclusion which renders the investigation of the wheel animalcules so important at present, and which causes regret that Mr. Hudson does not apparently include the morphological significance of the class within his range of study.

C. S. MINOT.

PROPER NAMES.

THE subject of proper names, on which we have an extended scientific literature, has so far not had the good fortune to fall into the hands of a writer possessed of both philological training and the talent for making his subject popular. The author of the present work disclaims all pretensions to have produced a philological treatise: indeed, the specialist would very soon remark, that, for such a task, Dr. Kleinpaul is hardly well enough versed in the principles of the modern school of philologians, if he makes such observations as this one: "Es fragt sich nur ob *sosor* ein *t* eingebüsst oder *schwester* ein *t* eingeschoben hat" (p. 51). *Sosor* (later *soror*) cannot have lost a *t*, because *st* is about the most persistent combination of consonants to be found anywhere, and the *t* is never lost in Latin.

Leaving out of the account a number of 'philological' excursions of this character, which the author might have very well dispensed with, as they have little or no bearing upon the subject, we must admit that Dr. Kleinpaul has produced an extremely readable book, based in its details, in the main, upon the latest and best authorities on etymology, with the exception of a few words where the author adheres to antiquated derivations (cf. *daughter*); while the general treatment and classification of the subject-matter are decidedly interesting and original. The book is not, like some others of similar pretensions, merely a dictionary of curious names, like the puritan What-ever-may-contrive-those-which-are-to-you-contrarious-praise-God Pimpleton, or the aristocratic Von-der-Decken-vom-Himmelreich-zum-Kuhstall, although such are also treated of in their proper places; but it is an attempt at a logical, not a philological, classification of proper names according to their origin; and while, of course, the list of names must necessarily be incomplete, it seems that the author has overlooked no important source from which names for in-

Menschen- und völkernamen. Etymologische streifzüge auf dem gebiete der eigennamen. Von RUDOLF KLEINPAUL. Leipzig, *Reissner*, 1885. 8°.

dividuals, families, or peoples, are drawn, — from favorite national dishes, like Jack Pudding for an Englishman, and Käsekrämer for a Swiss, to the cardinal virtues, like the Puritan Faith and Charity; from bodily peculiarities, like Oedipus ('swollen foot') and Colfax ('black hair'), to offices and dignities, like Schulze and Richter; from calendar-terms, like Augustus and Robinson Crusoe's Friday, to meteorological conditions, like Storm and Schneidewind; from trades and occupations, like Smith and Taylor, to articles of dress, like Caligula and Quijote; from oaths, like Jasömirgott (*ja, so mir Gott sc. helfe*), to kind parental wishes, like Fürchtegott and Bleibtreu.

These principles of forming proper names are classified and grouped in logical sequence, and they are considered in their proper relations to the growth of human society. We wish to take issue with the author upon the principle laid down in the introduction; viz., that the first source of proper names is to be found in the limitation of general terms. Thus a primitive tribe, separated from other people, would call the only river in the vicinity of their domicile 'the river,' but, on becoming acquainted with other rivers, would apply distinguishing epithets to their particular river, calling it, for example, the Red River, thus forming a proper name. There seems a certain lack of logic in this reasoning, because, as long as a people know only one river, the term 'the river' is really a proper name, and it only ceases to be one when the people begin to apply the same word to all objects of the same kind. Thus it would be more correct to say that proper names are the starting-point; that they afterwards become generic terms by being applied to other objects of the same kind; and that, as necessity arises, new proper names are formed from them by the addition of distinguishing epithets.

The strength of the book lies in the fact that not only odd and rare names are taken into the account, on the origin of which we necessarily reflect when we meet them, but the origin of the most common every-day names has received a philosophical treatment. This strength of the book is also its weakness. The author, forgetting that he was not to give us a dictionary, has not always confined himself to mentioning a few characteristic examples, but has given us, in many cases, all the instances that have come under his observation, thereby increasing the bulk of his work without making it sufficiently complete to be used as a work of reference. The various tables, especially those at the end of the work, which show to what extent certain principles of creating proper names prevail among different nations, are unique and interesting. The idea deserves to be carried out more fully in a future edition.

The book will recommend itself to English readers by the clearness and unaffected simplicity of its style, which contrasts very favorably with the style of many German works on related subjects.

KING OF THE BELGIANS' PRIZE.

A PRIZE of 25,000 francs, or $5,000, is offered every year by Leopold II., the king of the Belgians, we learn from the Journal of the Society of arts, for the best essay on some predetermined subject tending to advance the well-being of mankind. The competition is alternately restricted to Belgians, and thrown open to the world, being settled by an international jury. The subject of this year's competition, open to the whole world, was 'The best means of improving sandy coasts;' and the prize has been awarded by an international jury, including some of the most eminent English and French engineers, to M. De Mey, engineer of *ponts et chaussées*, Bruges, against fifty-nine competitors. This is only the second time that the international prize has been awarded; that in 1880, the year that the prize was instituted, having been adjudged to M. A. Wauters, archivist to the Brussels municipality, for his 'History of the origin of communal franchise in Belgium.' The subject for the essay at the next international competition is 'The progress of electricity applied to motive power and illumination, its applications and economical advantages.' The essays for competition, which must be written in French, or translated into that language, are to be sent before the 1st of January, 1889, to the minister of agriculture, industry, and public works, from whom the conditions of the competition may be obtained.

THE Haager society for the defence of the Christian religion has offered a prize of 400 Holland gulden — or medals, if preferred — for the best treatment of the two following subjects: 1°. A history of the application of historical criticism to biblical study, in order to establish a position which shall, if possible, avoid both dogmatism and scepticism; 2°. A biblical apologetic, or a comparison and estimate of the manner in which religion is unfolded and defended in the various books of the Bible. The competing essays must be signed with a motto, and forwarded, together with a sealed envelope indorsed with the motto and giving the name of the author, to Prof. A. Kusnen at Leyden before the 14th of December, 1886. The essays may be written in Latin, German (with Latin letters), French, or Dutch.

SCIENCE.

FRIDAY, MAY 7, 1886.

COMMENT AND CRITICISM.

THE STATEMENTS of the report and conclusions of Mr. Allison's commission, which have appeared in the public prints, and were partially reproduced in our last number, we learn, on good authority, to be premature in several respects. The fact is, that the commission has not finally formulated either a bill or a report, and may not do so for a week or more. What it has done is to vote on certain general conclusions; to direct its members to draw up reports expressing the views of the commission, or those of the individual members, on points in which they were a minority; to authorize the members to introduce bills expressing their individual views; and to remove the seal of secrecy from the proceedings. In reaching general conclusions, the commission, by a vote of four to two, decided to make no change in the coast survey, and it is not even believed that any legislation defining its work will be formally recommended. The members are unanimously of opinion that the policy of the signal office should be moulded with a view of erecting it, at no distant day, into a civil bureau, but on the question of making the change immediately they are equally divided. They are opposed to the school of instruction at Fort Myer, as now conducted, and, it is said, to what is known as the study-room in Washington. In the matter of the geological survey, they are of opinion that its operations should be restricted by law in the direction indicated by Mr. Herbert's bill, mentioned in our last number, but are not yet agreed upon all details.

All parties will agree that this is a very lame conclusion of two years of such careful investigation as has been bestowed upon this subject by the commission. The only parties that can be pleased are those who, knowing how broad and easy is the road to bad legislation, and how narrow the path to that which is good, will be grateful that more harm has not been done. The most curious feature of the conclusion is, that the complaints which gave rise to the investigation appear to have been only lost sight of; and the only organization which comes in for serious condemnation is one against the integrity of which no charge has ever been made, except to be refuted. It is now conceded by all disinterested parties, including the members of the commission, that the geological survey has been conducted with the highest ability and integrity, and in accordance with the laws making the appropriations for its support. The ground of complaint is, that it has undertaken too wide a range of geological and allied investigation, not pertaining to its proper functions; that it has secured political support by employing a large body of scientific men scattered over the country in these investigations, and has put the government to great expense in printing the results of such work. Paleontological research seems to have come in for the largest share of condemnation; mainly, we suppose, on the authority of Professor Agassiz, who claims that such research is not a proper function of public geological survey.

On the merits of so broad a question as this, including innumerable details within its scope, it would be unwise to pass a summary judgment. The views expressed in Mr. Herbert's report form, however, a legitimate subject of examination. If correctly reported in the public prints, they are not characterized by judicial impartiality and fairness of statement. For example: he gives what professes to be an exhibit of the cost of the geological surveys in nearly a dozen different countries, so widely separated as Canada, Japan, and Victoria, without any statement of the considerations which determine their selection, and finds that the aggregated cost does not exceed that of our own geological survey. But he gives no definition of the objects and limitations of these various surveys with a view of determining to what extent they are identical with our own. We believe, that, as a matter of fact, the geological survey of England has been completed for some time, and that the work now done, on the small cost of which Mr. Herbert lays stress, is not properly a survey at all. An advocate of the other side might with equal fairness have taken the cost of all the surveys now in progress in

England, and shown that that country alone appropriates twice as much for its surveys as we do. Again, a list is given of some seventy persons having other employments; most of them being college professors, who have been employed by the geological survey. The report fails to state that this list is in no way a list of employees, but a complete list of persons who at some past time have received one or more payments from the survey, for some special service rendered, without being in any way permanently connected with it or salaried by it. It is clear that a final conclusion cannot be drawn from statements like this until the other side is heard.

IN THE JANUARY NUMBER of the *Nineteenth century*, Mr. Frederic Harrison published an article on the practice, now so common, of spelling foreign and ancient names as they are spelled in the original tongues, even in cases where an anglicized form of the name has been long in use. He spoke particularly of the re-writing of familiar Greek names in conformity with the original spelling, and also of the names of persons and places in the earliest history of England. This practice he characterizes as 'a pedantic nuisance,' and makes some very good points against it. He remarks that "'Alfred,' 'Edward,' and 'Edgar' are names which for a thousand years have filled English homes and English poetry and prose. To re-write these names is to break the tradition of history and literature at once;" and he speaks in the same way of the re-writing of familiar Greek names. He also asks where the practice is going to stop, and thinks "we shall soon be invited to call 'Moses,' 'Môsheh,' as his contemporaries did; 'Judah' should be written Yehûda;' 'Jacob' will be 'Ya'aqôb;' and 'Jesus' will be 'Jehoshua.' In short, Mr. Harrison condemns the practice in unqualified terms, on the ground that it violates the established usage of English literature without conferring any compensatory benefits.

To this article of Mr. Harrison's, Mr. E. A. Freeman has replied in the April number of the *Contemporary review*. Mr. Harrison had spoken of Mr. Freeman as one of the worst offenders in the matter in question, and the historian's reply is little else than a personal vindication of himself. Viewed in this light, his article is more or less successful, and he convicts his opponent of some mistakes and inaccuracies. But, as a defence of the practice that Mr. Harrison condemns, we are obliged to say that Mr. Freeman's reply is unsatisfactory. Indeed, he doesn't argue the main question at all, but treats the matter as little more than a personal affair between himself and Mr. Harrison. This is disappointing; for the question involved is one that greatly needs a final settlement, and such a settlement can only be reached on some ground of principle. The question is, whether we are to write all foreign names as they are written in the original languages; and, if not, then what ones we are to write in that way, and what ones are to be anglicized. Mr. Harrison shows that the writers he criticises are not at all consistent with themselves; and Mr. Freeman virtually admits that his own practice is not consistent, and that he doesn't follow any general rule. He says that he writes 'Aelfred' and 'Eadward' because he finds these names so written in the ancient authorities; but, nevertheless, he writes 'Rochester' and 'Canterbury,' although the old forms of these names are 'Hrofesceaster' and 'Cantwarabyrig.' He says, too, that he writes 'Buonaparte,' pronouncing the word in four syllables, for the reason that he learned to do so in his childhood, which strikes us as no reason at all. We hoped, when we took up Mr. Freeman's article, to find him laying down some definite rule or principle which might serve as a guide to all writers in this perplexing matter; and we are disappointed at finding that he does not even attempt to do so.

STORIES OF THE OCCURRENCE OF PETRIFIED FLESH, or of frogs and toads enclosed in solid rock, and other fables of the same nature, frequently appear in the daily and weekly papers. One not dissimilar, though vastly more absurd, of the finding of two living bats embedded in a solid lump of bituminous coal, from a coal-mine in Maryland, is now going the rounds, and will probably not rest till the press from Maine to California has given publication to it. There was said to have been no crevice admitting the entrance of these wonderful bats, and that there was a clearly formed impression left by them. The inference, no, the only 'conclusion,' is, that these hoary chiropterans are living remnants of the coal-forming age. It was not long ago that just such a story was told of an ancient toad in another coal-mine, only this time the carboniferous

batrachian had become, as was naturally expected, very much desiccated. It is very strange with what persistence such myths and fables retain their hold on popular credence. Men of high intelligence will aver their belief in petrified human bodies, and we have known a shrewd business-man to exhibit what he firmly believed was a large mass of fossil buffalo flesh, sinews, muscles, blood and all. What more natural thing could there be than the finding of a toad or bat, dead, hibernating or active, in the crevices of a coal-mine? and yet, doubtless, to one wholly unacquainted with geological and zoölogical principles, a carboniferous fossil fish or living bat seems equally inexplicable and wonderful. Such fanciful flights of imagination might pass unnoticed, were they not so industriously circulated in the columns of even the highest class of metropolitan newspapers.

THE COAST SURVEY AND THE NAVY.

THE latest argument for the transfer of the coast survey to the navy department is embodied in a paper by Lieutenant Dyer, U. S. N., recently published in the Proceedings of the U. S. naval institute. A very slight examination of this production shows that the author travels over an easy and well-trodden path instead of grappling with the real difficulties of the question. Nothing is easier than to demonstrate to the satisfaction of any writer who chooses to espouse the cause, that the coast survey ought to be turned over to the navy department. If nothing more were necessary than a "Be it enacted, etc., that the hydrographic work of the coast survey shall be transferred to the navy department," the problem would be a very simple one. It is to this simple form of it that all the arguments heretofore brought forward by the navy department have been directed.

Fault can be found with every system of public administration; and the thought, "How much better we could manage things if congress would put us in charge of them!" will be prevalent so long as human nature remains as it is. The real difficulties of the question begin when we attempt to decide just what work, what records, and what appliances shall be transferred to the navy department, and how the navy department shall utilize the appliances and carry on the work. One difficulty met with at the very start is found in that custom of the naval service which requires that almost every officer, certainly every young and energetic officer, shall change his duty at the end of every three years. Howsoever well a cadet at Annapolis may be trained in the theory of marine surveying, he cannot possibly acquire at the academy that experience in practical work of any kind which is necessary to its effective prosecution. His first year, perhaps his first two years, in the work of the survey, would be very largely taken up in learning how to do it, so that he would hardly have become an expert before he must leave to keep watch on board a ship of war. Of course, we refer here to the more difficult and technical work of chart-construction, and not to such matters as running a line of soundings. It would therefore be a necessity of the service that a permanent corps of skilled map-makers should be organized, or that a part of the existing corps should be transferred. Even then it would be contrary to naval custom to allow these civilian assistants to hold any other than subordinate positions; and all branches of the direction, from the head of the office down, would be intrusted to men who were continually changing.

This is a consideration which would have to be kept in view in deciding what work should be transferred. One important function of the survey is the study of the effect of tidal and other action upon harbors. We all know that most of our harbors are in a continual state of change; and the study of the causes of such changes can be effectively prosecuted only by experts who make it a considerable part of the business of their lives. Can the navy be relied upon to furnish such experts? Tidal observations at numerous points along the coast form an essential part of the work. Will they be effectively kept up under the continual changes of naval administration? Can the records of the coast survey which pertain to hydrography be separated from the others and transferred to another department without any inconvenience? If not, can the navy department get along without them, and not waste labor in repeating work already done? Can a portion of the draughtsmen and engravers be transferred, or must new men be employed in their places?

We suggest these questions, not claiming that their solution presents insurmountable difficulties, but only as showing where discussions should be directed in order to be effective. Such general considerations as Secretary Chandler and the naval officers have presented on the subject may be very

effective in starting people to think about it, but can never suffice to show what policy should be adopted. To demonstrate what ought to be done is one thing; but to show how to do it is, as all practical men know, a very different and generally a much more difficult thing. We hope, therefore, that if our naval friends, for whose professional ability *Science* entertains the highest respect, really desire the transfer, they will present such a detailed plan of proceeding from beginning to end, that every one shall be able to understand and criticise it. Until they do this, they must not expect to excite congress to action.

We may add one general consideration. A considerable number of naval officers are actually engaged in coast-survey work. Is not their work as effectively performed under the present system as it would be if the navy department had charge of it? What would the officers themselves, or the navy at large, gain by the transfer? We are aware that Secretary Chandler considered it a very great hardship that officers should be removed from the immediate control of the department to which they belong. But where does the real evil come in? These questions must be answered, and the public benefit to be gained by the change must be made clear, before the project can receive the really effective support of scientific men. The latter are not disposed to prejudge the question, but before supporting the measure they want to be satisfied of its practical advisability; and this can be done only by the advocates of the change fully considering such questions as those above suggested.

COMPOSITE PORTRAITS OF AMERICAN INDIANS.

ON the plate accompanying this number is given, so far as known, the first presentation of composite portraits taken of North American Indians.

No. 1 is of three full-blood Dakota or Sioux young women belonging to the band commonly known as the Brulé, and living at the Crow Creek agency, Dakota territory. Their ages range from nineteen to twenty-three years. Their average height is five feet six inches and a half; their average weight, a hundred and forty-one pounds. This composite is made from photographs taken on the same day and in rapid succession. On the same afternoon, composite No. 2 was taken from the same persons, each one sitting her allotted seconds before the camera. In No. 1 and No. 2 the order of the faces is identical, and care was exercised to try and procure similar results in the portrait; but, as will be observed, the composites are different. The controlling face in No. 1 is given in picture No. 3, which was the first photograph to be exposed in making up composite No. 1. The dominant face in No. 2 is given in picture No. 4. It belonged to the last sitter, and her photograph was the last one exposed in making composite No. 1. In two composites similarly made, of Omaha women, the one from sitters varies in a like manner from the one made up from photographs, only in a different order. In the one from life the broad face of the last sitter controls the composite, and in the other the long face of the first photograph influences the picture. This variation of composites made from the same faces — one taken from life, the other from photographs — is mentioned for what it may be worth.

A composite of Omaha men, a cognate tribe, differs but little from a Dakota composite, except in the eyes. In the Omaha composite the eyes are larger and fuller. The height and breadth of head, the strong but not unduly heavy lower face, are noticeable in both Omahas and Dakotas. A composite of Omaha women does not differ in any marked manner from the Dakota portrait. In both the pictures of the women, there is to be observed a similar variation between the female and the male of the same tribe, notably in the shape of the head, and the greater prominence, proportionally, of the cheek-bones in the women's faces.

It is premature to judge of the value of composite portraits. They are certainly curious and interesting, and many points will occur to the observer of these Indian faces. In a general way, they seem to confirm the results of a close study of the home-life and the various customs, including the most savage rites of war and religion, made by the writer among this family of Indian tribes, by showing them to be a people, intellectual rather than brutal, unawakened rather than degraded. The portraits indicate the stamp of tribal fixity, and reveal the unconsciousness within the individual of the analytical powers of mind by which man masters nature, — a peculiarity which is the key to much in Indian sociology and religion.

The writer is indebted to Mr. Jenness Richardson of Washington, D.C., for the making of the composites.

ALICE C. FLETCHER.

GEOGRAPHICAL NOTES.

Siberian trade-routes. — The practical failure of the route by sea has stimulated the search for routes of inland communication between Russia and Siberia. The latest investigations are those be-

tween the Petchora and the Obi, under the auspices of Sibiriakoff and others, through the northern Urals. There are, it appears, several passes, the best probably that of Shokurinsk. This is ninety-eight miles long, and extends from Kurga on the Petchora, a town accessible by steamers, to the Sigva River, an affluent of the Sosva of the Obi basin. The pass is only 1,450 feet above the level of the sea, and 1,150 above the Sigva. A railway a hundred miles long will therefore connect these two great water systems, and avoid all the perils of arctic navigation in the Kara Sea and Gulf of Obi. Another pass, the Voikarski, is of about the same length, but rises two hundred feet higher.

Partition of Patagonia. — Patagonia has disappeared from political geography. The Panama *Star and herald* announces the result of the agreement, in regard to this region, by Chili and the Argentine Republic, who have absorbed it. To Chili has been assigned all the western slope of the Cordillera to the southern extreme of the continent, to the Strait of Magellan, and all the islands off that coast. The eastern slope of the range, and the vast pampas extending to the Atlantic, are now the property of the Argentine Confederation. The Strait of Magellan is declared neutral, and free to all nations. The chief island of Tierra del Fuego is parted equally between the two nations, Chili taking all the other islands, including that of Cape Horn.

Miscellaneous. — It is announced that news has been received from Ghardaia, in the Sahara, of the assassination of Lieutenant Palat the explorer. He was murdered by his Mohammedan guides two days after leaving Insalah. It is alleged that his death was due to the Senousian fraternity, the fanatical association, whose members were the assassins of Colonel Flatter's party in the same region, and are held responsible for the death of numerous other explorers. Baron Kaulbars, after nine years' labor, has finished a new chart of South America. It is published by Iliin of St. Petersburg, in eight sheets, and on a scale of 1 : 6,300,000. The author is now engaged on a chart of Africa, to have the same scale. It is said, that, after the fixing of the frontier line by the Russo-English commission, many of the Turkomans living on the fertile slopes of the Afghan mountains have moved to the Russian side of the line. As the country on this side is a desert, it is supposed that they cherish the idea that they will hereafter have an opportunity of raiding the Afghan settlements from Russian territory, — a course which would be likely, if not energetically repressed by Russia, to raise anew many international complications. Lieutenants Ryder and Bloch of the Danish navy will devote this summer to hydrographic explorations in the district of Upernavik, Danish Greenland.

PARIS LETTER.

SINCE my last letter, a good deal of stir has been created in some circles by the death of three of the Russians sent to Pasteur, after having been bitten by a mad wolf. As is always the case, some persons cannot believe in methods that are liable to miss fire now and then: they think that medicine and physiology ought to be as precise and unvarying as mathematics; they cannot understand that he who operates on living matter, operates on the most moving and varying of all grounds. No person of scientific training will wonder if Pasteur does not always meet with success: in fact, the experiment has only just begun, and we shall have to wait some time before a legitimate conclusion may be reached. I do not suppose that the fiery attacks of Rochefort, the renowned — and sadly renowned — pamphleteer, on Pasteur's experiments, are even able to attract the great experimenter's attention. They are good enough to amuse a few, but that is all.

However, as many newspapers have seemed rather dismayed by the death of the three Russians, and as some persons have seemed to be shaken in their confidence, M. Pasteur has deemed it advisable, at the meeting of the Academy of sciences, on the 12th of April, to give his opinion on the question. In his last paper, then, he begins by recapitulating the whole number of persons attended to by himself. At present this number is 688, of which more than half have outlived the more dangerous period, — that during which rabies is most likely to develop. Turning then to the question of the great danger of rabies communicated by wolves, he quotes many documents referring to the same, showing that recovery is very rarely met with. In Russia it is generally considered that persons bitten by rabid wolves have no chance of escaping their fate: and it must be noticed, as M. Pasteur remarks, that in such cases the duration of the period of incubation is remarkably short. But the fatal effects of the wolf's bite is not due, according to Pasteur, to any increase of rabid virulence in the wolf. The virus is not, or at least does not seem to be, any stronger in the wolf than in the dog; but as the wolf usually inflicts very severe bites, especially on the face and hands, the virus penetrates the body with much more ease. Such is, in Pasteur's opinion, the reason of the seriousness of rabies communicated by wolves. This opinion has led him to alter somewhat his method in cases where rabies is of wolfish origin: he is to tell us some day how he has altered it, and with what success.

Professor Vulpian, the eminent physiologist, has been recently elected *secrétaire perpétuel* to the Academy of sciences, in the place of Jamin. The election was a close contest. M. Henri Milne-Edwards was the other competitor, and the museum backed him solidly; but it was of no use: the son does not possess the influences the father exerted. It must be said also, that, from a general scientific point of view, Vulpian is far superior to his opponent as an original investigator and as a man of great culture. M. H. Milne-Edwards's works are rather few, while those of Vulpian are numerous and widely known. Among his principal contributions, we shall recall the following: 'Leçons sur la physiologie du système nerveux;' 'Leçons sur les vaso-moteurs;' 'Leçons sur les substances toxiques et médicamenteuses;' 'Leçons sur les maladies de la moelle.' Vulpian is a very kind-hearted and most excellent man. He is much loved by all the students, and is a man of high character. His whole life has been devoted to science, and, although a physician, he has never sought to extend his practice. It must be remembered, however, that he has been called upon to give his medical advice concerning two illustrious patients, — Count of Chambord, and Victor Hugo. It is generally believed that M. Brown-Sequard — well known in America — will be elected a member of the academy in Vulpian's seat, since it is the custom for the *secrétaires perpétuels* to resign from the section to which they were elected.

At the meeting in which Vulpian was elected secretary, M. Bouchard, professor in the medical school, read an interesting paper on the toxicity of urine during sleep and during waking hours. At the close of day this liquid is rather inoffensive; but, as sleep comes on, it grows more and more toxic: eight hours after waking, it is the most toxic possible. The symptoms of urine-poisoning are different with night and day urine. In the second case the symptoms are similar to those brought on by narcotics: in the first they resemble those provoked by convulsing poisons. Upon the whole, then, day urine tends to bring on sleep; and night, to awaken the sleeper. Professor Bouchard's paper is a very interesting one, and we have no doubt as to his obtaining very important results by continuing these experiments.

At the Académie de médecine, M. Marc Sée, at a recent meeting, read an interesting paper on the surface of the pulmonary vesicles. It is known, that, according to Küss, this surface is some two hundred square metres. M. Sée does not think that it is so great, but he still believes that it is equal to 130 or 135 square metres; that is, about ninety times the skin-surface. As it is, this surface is something enormous.

You may have heard some time ago of a very sad accident that happened in a mining-district near Périgueux, in the south of France. A sort of avalanche of rocks and earth buried a large number of workmen, and it was hoped for many days that they would be saved, because they might have taken refuge in caves in the hill when the avalanche occurred. In fact, it is certain that the unfortunate men were not — all, at least — killed by the accident. After every thing had been done to rescue them, and it was found impossible, owing to the immense quantity of materials to be bored through, a long hole was bored down directly to the caves, large enough to admit of the passing of provisions and tools. As nothing was heard, an effort was made to see what was going on within. An engineer and a photographer then devised a very ingenious plan. They sent down into the hole an electric lamp strong enough to illuminate the whole cave, and after that a photographic apparatus. The plate, after some time of exposure in the cave, came up, sure enough, perfectly impressed. But it revealed a ghastly scene. One of the bodies of the men — quite recognizable by the miners — was lying near the apparatus, and evidently had not long been dead. Near and around him pieces of other bodies were to be seen, and they were so disposed as to make it probable they had been torn from some corpse by the survivors. There is no reason, after the photographs, to suppose that these bodies were mangled by the accident, as they were quite *à l'abri* of the avalanche itself; at least, if they had been so mangled, these fragments could not have come naturally, or have been brought to the place where they were, unless by the survivors. This shocking tragedy has created a great excitement among the miners, who are convinced, that, if more haste had been made, some of the victims might have been saved. At all events, the idea of MM. Siemens and Langlois — the engineer and photographer — has proved a very ingenious one, and one that may be resorted to in similar cases.

The Gheel colony is certainly well known on the other side of the Atlantic. It is a colony for lunatics, where the no-restraint system is the only one used. The insane, instead of being shut up in cells or asylums, are committed to the care of the inhabitants of the country with whom they live, as would sane persons, for a very modest payment. This system is a very old one, and Gheel is unique in the world; the inhabitants being trained to keeping the insane, and living with them, for many centuries. However old, the system seems to be very good, at least for a large proportion of insane who do not require to be shut up, and to whom life in the open air seems to be

very beneficial. The Belgian government has decided to try and create a second Gheel, and has chosen Lierneux, wishing to have a Gheel where French is spoken, for the benefit of the part of Belgium where French is the only language understood, as Gheel is in the Walloon part of that country, and is very inconvenient for French-speaking insane. This plan seems to meet with success, and Lierneux is already provided with a number of patients, and with a committee for inspection and surveillance. We hope that Lierneux will thrive as well as Gheel has and does. I visited Gheel two years ago, and convinced myself that the insane are under happier and in healthier conditions than in asylums, and that if they are well looked after by the authorities, they are as well nursed and cared for. I may add, that, when a system has outlived some centuries, there must be some good in it.

A Parisian physician, Dr. Sandras, created some time ago quite a sensation in the medical world by a paper on the possibility of modifying the human voice to an unprecedented extent by the use of different inhalations, bringing to the larynx air saturated with different vapors. His opinion is based exclusively on experimental tests, not at all on theoretical views. Dr. Sandras pretends to be able to change the nature, intensity, pitch, and extent of the voice in quite a surprising manner. For instance, after ten or twelve inspirations of alcoholic vapors, the voice becomes quite hoarse, and cannot give more than five or six different notes. Inhalations with Guyot's *eau de Goudron* enfeeble the voice; on the contrary, *eau de Botot* strengthens the voice in a very marked manner; and with some essences — Dr. Sandras does not say which — this strengthening is so very great that the voice acquires new notes, high as well as low. Other substances confer only low notes; and others, only high ones. If the facts discovered by Dr. Sandras prove to be true for other persons than himself, this discovery will be very useful to singers, preachers, lawyers, and all persons generally that are obliged to use their voice a great deal. If it is also true that hoarseness of the voice brought on by cold can be cured in a few minutes, I do not doubt that the method will be much appealed to. For singers, certainly, the possibility of increasing the number of notes of the voice, either in the upper or in the lower or in both keys, will be much appreciated. Experiments with Dr. Sandras's method are to be made in the Conservatoire de musique.

The second number of the *Archives slaves de biologie* contains many interesting papers. One of them is by Professor Anrep, on ptomaines. The author has witnessed many cases of poisoning by preserved fish (sturgeon) in Russia, and has been able to isolate and extract the poisonous substance by the Stass-Otto method. The ptomaines so obtained are very toxic; and the symptoms brought on in animals very much resemble those of the principal depressing and paralyzing poisons.

Prof. A. Gautier has recently published an account of his experiments and researches on ptomaines and leucomaines. The facts he has discovered are very interesting indeed, and he has opened new ways in chemistry and physiology. The first leucomaine discovered was creatinin, found by Liebig and Petenkofer in 1849. Since then, M. Gautier, in 1881, following researches begun by his pupil, G. Pouchet, and beginning new experiments of an entirely different order, has been able to isolate many leucomaines very analogous to ptomaines, but quite different in that they develop only in living organisms. Leucomaines are found abundantly in the muscles: they are of many sorts. Xantocréatinine, crusocréatinine, amphicréatine, pseudoxanthine, are the most important. As to the manner in which these leucomaines originate, Professor Gautier cannot say, but he believes that the oxygen brought into the organism is the most efficient agent in the destruction of these poisons. They all oxidize very easily. Of course, if, for some reason or other, oxygen is less abundant in the blood (anaemia, chlorosis, etc.), leucomaines may become very abundant, and exert a toxical influence on the organism. Professor Gautier's experiments are very interesting from a physiological point of view: they may also become a standpoint for very useful pathological applications, because it is very natural to suppose, that, if leucomaines are able to originate and accumulate in a certain quantity in the organism, they must surely, in some cases, represent the origin of sundry diseases, or at least certain symptoms, hitherto unexplained or misinterpreted.

Yesterday evening, the Stanley club, which comprises the leading members of the Anglo-American colony in Paris, gave a dinner at the Continental hotel in honor of Pasteur. M. MacLane presided, and at the end of the dinner proposed a very appropriate toast to Pasteur, concluding as follows: "The United States, represented by the Stanley club, give you greeting, sir, as one of the most illustrious of those *esprits d'élite*, and, while proposing your health, I express, on America's behalf, the hope that your career, already filled up with so many great works, shall be yet a durable one, for the joy of those who suffer, and for the instruction of those who learn by your example how disease may be overpowered by labor and science." M. Pasteur answered M. MacLane, giv-

ing interesting details of his work, and also of his own character and temper. The passage is worth while quoting: "There are two men in me, — the one, timid, self-defiant, and of *humeur facile*, who accepts thankfully good advices and discussion; the other is a great deal less easy to manage. When, after having thoroughly used all the resources of experimental science, I am quite sure of having attained to truth, a second man arises in myself, absolute, very harsh in discussion, and of *humeur farouche*. . . . I am no more in November, 1885, timid, troubled, sleepless, always haunted by the nightmare of rabies. We are in April, 1886. Having called to aid all the resources of experimental science, I am now in possession of the exact scientific truth concerning this question." M. Pasteur concluded in proposing the joint health of America and France, "two nations formerly sisters on the battle-ground." Toasts were next proposed by M. de Blowitz and de Lesseps, and the meeting broke up after mutual expressions of sympathy and good feeling had been freely exchanged. H. V.

Paris, April 15.

NOTES AND NEWS.

A STRANGE nuisance of rats has developed itself in some parts of New York City, reaching such an extent as to call for an examination of the circumstances by the proper city authorities, and making dwellings almost uninhabitable. These animals are known to possess a remarkable migratory instinct, congregating in large numbers, and overrunning whole regions, to afterward as suddenly and strangely disappear. Dr. Buckland relates instances of their migration from house to house at certain times of the year, influenced probably by the lack or abundance of food. In a certain part of Berkshire, England, there were situated a number of isolated barns on the bleak, barren downs; and the rats were frequently met in colonies at early morning, marching in long lines direct from one barn to another. They were watched, and seen to go directly across the country in a straight line; and the most curious part about the circumstances was the instinct that told them where to go, or to find those barns which contained grain. At Central park there is no unusual number, though they find in spring plenty of food along the lakes in the grain fed to the swans and other aquatic birds. This grain is placed in boxes at some little distance from the water's margin, but the rats are not thus hindered from purloining it: they swim to the boxes, extract the grain, and then swim with it back to the shores. In the winter they collect about the animal houses. In the Philadelphia zoölogical gardens they have been very numerous, and not a little of a nuisance.

— Mr. Charles Rhodes of Oswego, N.Y., has lately published a circular giving the monthly and annual levels of Lake Ontario at Oswego for a number of years, as determined by records of the army engineers. The variations of level seem to be irregular, and are not well explained. For example, in April, 1873, after eighteen months of low water, the lake rose about two feet and a half in twenty days. When it is considered that the whole inflow of the Niagara during that time would scarcely more than produce the rise, even if the escape by the St. Lawrence were stopped meanwhile, the magnitude of the change may be appreciated, but can hardly be well accounted for. Mr. Rhodes also gives account, in a personal letter, of oscillations in the water of the lake that seem to correspond to the *seiches* of Lake Geneva and other Swiss lakes. He describes sudden flows of the water from Lake Ontario into the Oswego River, with a rise of ten to eighteen inches, followed, in half an hour or so, by an equally sudden discharge and fall, going as much below the ordinary level as the rise had been above it. Smaller oscillations succeed, gradually fading away. All such large and sudden fluctuations are followed by storms of wind, rain, or both. These singular phenomena, so well studied out by Forel in Switzerland, have received but little attention in this country. The records of lake-levels kept by the army engineers would probably afford many examples that should receive investigation.

— At one of the recent sessions of the Prussian Landstag, it was stated that the rigorous laws adopted in 1880, relating to rabid animals, had produced most excellent results. These laws impress the necessity of veterinary examination of all animals suspected of rabies, and if, in any case, the presence of the disease is determined, require that all animals which have been exposed to danger shall be immediately killed. Furthermore, in any district where a rabid cat or dog is seen, it is ordered that all dogs shall be confined or muzzled. As a result of these laws, there has been a steady decrease in the number of mad dogs. In 1880–81, 672 rabid dogs were killed; in 1881–82, 532; in 1882–83, 431; in 1883–84, 350; in 1884–85, 352. During the first of these years (1881–82) 2,400 other dogs, which had been exposed to the danger of contagion, were killed; in 1884–85 the number was 1,400. The number of human deaths has decreased in the same ratio: thus in 1880–81 there were ten; in 1881–82, six; in 1882–83, four; in 1883–84, one; and in 1884–85, none.

— The Smithsonian institution received last week a foetal pygmy sperm-whale (Kogia breviceps) from Mr. George Sayers, keeper of the Sea Island city life-saving station, New Jersey. It has been discovered that this species of Kogia breeds at this time of the year. Last May a specimen was also sent to the institution. Early this winter a female of this species was received, containing the smallest foetus of this cetacean ever found, not more than six weeks old.

— The naturalists of the fish commission steamer Albatross, which is now engaged in taking soundings among the Bahamas for the hydrographic bureau of the navy department, have recently sent home a part of their collections in this locality. Besides several new species of birds, the collection contains a number of specimens of Kirtland's warbler, which, ornithologists will remember, is a very rare species to our fauna. Very few specimens have ever been taken within the limits of the United States, and it is not until recently that its habitat has been discovered; in this locality, however, it is found in abundance. The Albatross will return from her work in the Bahamas on or about the 12th of this month.

— The off-shore seal-fishery of Newfoundland this year has not proved a success. The largest fare taken was about 34,000 seals; the average, less than 12,000; the total. about 163,300, divided among fourteen vessels. The fine steamer Resolute was driven by the ice upon a reef north-east of Fogo, and is a total loss. Once in every ten or fifteen years it happens, that, owing to the prevalence of easterly winds, about the time for taking the young seal, the ice on which they are is driven landward, and forced, a compact mass, into the northern bays, where vessels cannot follow. The residents along the shore then reap a harvest as long as the wind is favorable and the ice clings to the land. It is estimated that from 100,000 to 150,000 seal have been taken in this way this season, which is a godsend to the people, who are mostly very destitute. In some places the land-catch has averaged thirty per man, each worth about two dollars, of which the captor owns the whole; while on the steamers the owners of the vessels receive one-third of the catch.

— In a communication before the French academy of sciences on April 12, M. Pasteur stated, that, of the 726 persons treated for hydrophobia by him up to that date, 688 were bitten by mad dogs, and 38 by mad wolves: among the former there had been one, among the latter three deaths. From a collection of cases in man from the bites of mad wolves, he finds the percentage of mortality as high as 82, and the duration of incubation much shorter: he therefore concludes that there is greater virulence in the poison from this source. Instead of three deaths so far, among those bitten by the mad wolves, he believes that there should have been fifteen or sixteen, had his treatment been ineffectual.

— A lively discussion on the subject of the poisonous mussels of Wilhelmshaven (*Science*, vii. 175) yet continues in the German medical periodicals. From the conclusions already reached, it appears evident that simple stagnation of sea-water is capable of giving rise to poisonous qualities in the animals inhabiting it; and that, too, when the water may be uncontaminated by sewage or other impurities. Poisonous qualities precisely similar to those of the mussels have been observed in the star-fishes of Wilhelmshaven. The poison in the mussels has been isolated, and described as a ptomaine under the name of mytilotoxin: but Professor Virchow says it cannot be a true ptomaine, as it is not a product of decomposition. A large share of attention has been given, by the various writers on the subject, to the question whether these mussels are of a new and introduced form or not. It is generally agreed that they are not, yet there seems to be tolerably constant differences from the true Mytilus edulis, probably due to the conditions in which they grow. Professor Virchow adds a point of practical importance; viz., that the experienced fishermen of Christiania warn consumers against the use for food of mussels and oysters which have been attached to ships' bottoms, old wood-work, etc.

— The new microscope objectives, of which notice was given in *Science*, are more fully described in the last number of the Journal of the Royal microscopic society. They are receiving high praise, — 'the microscope of the future,' as Professor Abbe calls them, — and it is believed that high-power work hereafter will almost necessarily be done with them. The two $\frac{1}{8}$ objectives which have been received in England are composed each of ten single lenses, combined to form five separate lenses, with a single front lens; but the special point in their construction is that they are made of the new kind of optical glass which Professor Abbe and Dr. Schott have been working for the past five years to perfect. Of the ten lenses, two only are of siliceous glass, the other eight being made of borates and phosphates. The crown and flint glass ordinarily used by opticians does not contain more than six chemical elements, while the new glass contains no less than fourteen. This glass was discovered nearly three years ago, and objectives were then made

by Zeiss; but, as it was decided to establish a manufactory for the production of the glass with the aid of the money — $15,000 — voted by the Prussian government, Messrs. Zeiss were obliged to abstain from using it until it should be accessible to other opticians also. In a few months it is expected that the preparation for the supply of the borates and phosphates, as well as the siliceous glass, will be perfected, when both objectives and glass will be obtainable in the usual way. Mr. Nelson, who has examined one of the objectives, writes thus: "The great benefit which will accrue to microscopists from the use of lenses of this construction will be due, not so much to the absence of color, as to the greater freedom from spherical aberration. . . . It is decidedly the most brilliant objective I have ever seen."

— The department of physical education in Amherst college has lately included among its statistics those relating to the condition of each student's eyes upon entering college. The summary of the results obtained from the examination of the classes of 1888 and 1889, comprising 199 men, shows a larger percentage of impaired visual organs than might be expected. In the following table the percentages are given for the two classes combined.

Perfect vision, in both eyes, 14.0;	in one eye	18.0
Far-sighted, " " 86.5;	" "	8.0
Near-sighted, " " 15.5;	" "	8.0
Astigmatic, " " 15.0;	" "	7.0
Other defects		1.0
With good color-sense		93.5
With feeble color-sense		3.5
Partially color-blind		1.0
Completely color-blind		1.5
With blue eyes		54.0
With brown eyes		32.0
With gray eyes		13.5

The percentage of those with perfect vision in one or both eyes was nearly the same in both classes; but a considerable variation was observed in the number of the far-sighted, near-sighted, and those with imperfect foci (astigmatic).

— Mr. Scudder's 'Systematische übersicht der fossilen myriopoden, arachnoideen und insekten,' from Zittel's 'Handbuch der palaeontologie,' is a valuable *résumé* of our present knowledge of fossil insects, and one which fills a long-felt want. It is richly illustrated with excellent figures of the principal forms, and contains a concise and careful summary of the extinct genera. Entomologists, to whom the work should have its greatest value, will be glad to learn that it will shortly be published in English.

— The additions to the literature of bacteriology during late years have become so extensive and numerous that even the specialist can hardly keep pace with the publications constantly appearing. For this reason the new "Jahresbericht über die fortschritte in der lehre von den pathogenen micro-organismen" (Braunschweig, *Bruhn*, 1886), by Professor Baumgarten, will be welcomed by all those interested in this broad field. The first volume, for 1885, is a work of one hundred and ninety-two pages, comprising bibliographical lists of the separate papers and volumes that appeared during the past year, with abstracts of their contents, under the titles, 'Text-books and compendiums,' 'Parasitic micro-organisms (including micrococci, bacilli, actinomyces, and pathogenic spirillae, hyphomycetae, and protozoa),' 'Saprophytic micro-organisms,' and 'General technique.' The work cannot help but be very useful to both biologist and physician.

— The Société philomathique of Bordeaux has organized an international congress on technical instruction, which will be opened on Sept. 20 next, at Bordeaux.

— The falling-off in the average size of families in France, as shown by recent statistics, has induced the enactment of a decree re-affirming the law whereby every father of a family having seven living children may have one of his sons educated at the expense of the state.

— The Spanish Royal academy of sciences has offered premiums for papers on bird migrations and habits, as observed in the littoral and central regions of the peninsula. The particular subjects to which attention is directed, as given in *Cronica cientifica*, are very similar to those proposed by the bird-migration committee of the American ornithologists' union.

— Dr. E. Reyer of Vienna, who made a geological tour through this country two years ago, has lately published two profiles through the Sierra Nevada in a supplement to the *Neues jahrbuch für mineralogie*. He finds the evidence of faulting, down to recent dates, very distinct on the eastern slope of the range, even glacial striae being displaced at many points, and the downthrow nearly always being on the eastern side of the fracture. The eruptive masses, by which the sedimentary strata of the range are much disturbed, are generally regarded as younger than the sediments. Dr. Reyer modifies this view by supposing them to be older than the oldest strata which lie conformably upon them, although greatly disarranged from their original attitude by massive eruption-like overturnings. In the down-faulting origin of the Yosemite valley, and in many other points, he confirms the views of Professor Whitney.

— The summer course in entomology and general invertebrate zoölogy, of Cornell university, will begin Monday, June 21, next, and continue ten weeks. After completing an elementary course in either general zoölogy or entomology, the student may select some subject in systematic zoölogy, economic entomology, or insect anatomy, for special investigation. It is planned to have the work of each student, as far as possible, an original investigation. Members of this class will have free use of the library, and all other privileges of students of the university. Those desiring to join the class should make application to Prof. J. H. Comstock, Ithaca, N.Y., before June 10.

— From the returns of the German quinquennial census, in December last, it was found that Prussia has a population of 27,279,111, an increase of 3.79 per cent; Bavaria, 5,284,778, an increase of 2.49 per cent; Saxony, 2,972,805, an increase of 6.94 per cent, the largest of any of the states, the returns of which are so far available. In only a few provinces has there been a decrease; Pomerania, with 2.22, being the most important.

— The cold weather during the past winter in Florida, has, Dr. Riley finds, destroyed the injurious orange scale insects wherever it was severe enough to cause the shedding of the leaves. The eggs, however, were uninjured.

— The journal of the Society for psychical research for April contains a second instalment of Mr. Myers's 'Notes on the unconscious self,' which is principally devoted to answering the criticisms of Hon. Roden Noel on Mr. Myers's previous papers. Some interesting anecdotes on the general subject of mesmerism are given by C. Kegan Paul, the well-known publisher, and his sister. At a general meeting of the society, announced for the evening of May 3, Mrs. Henry Sidgwick was to read a paper on spiritualism, which was looked forward to with great interest.

— In tables just published by the U. S. geological survey, Mr. J. D. Weeks gives the total production of manganese ores in the United States during 1885 at 23,258 tons, with over seven thousand additional tons of manganiferous iron and argentiferous manganese ores. For the year 1884 there were 10,180, for 1882 only 4,532 tons. This includes only those ores containing over 44 per cent of metallic manganese.

— The small island Juan Fernandez, where Alexander Selkirk passed his four years of solitude, has been leased by the Chilian government to a Swiss named Rodt, who has established there a flourishing colony. M. Rodt exercises the powers of a viceroy, and has the fullest administrative authority. The chief occupation of the inhabitants is agriculture, but some branches of manufacturing industry are also practised. M. Rodt encourages immigration, and among the new Crusoes are to be found Austrians, Englishmen, Frenchmen, North and South Americans, South Germans, Swiss, and Spaniards. There are no Prussians, the governor having a rooted antipathy to Prussia.

— The tenth anniversary of Johns Hopkins university was celebrated April 26. The statistics show that the whole number of students admitted since its foundation is 923, of whom 19 have died. Addresses were made by Profs. W. H. Welch, and H. A. Rowland, and others.

— The Smithsonian has received the first evidence of the successful introduction of salmon in the head waters of the Potomac. Last week Mr. R. A. Golden, a fish-dealer in the Washington market, presented a fine specimen of the Sebago salmon to the institution, measuring over one foot in length. It was caught in a trap-net at Ragety Point; and the presence of this well-grown specimen in the Potomac waters is an earnest of what may be looked for in the future. The introduction of land-locked salmon in this river marks an important era in the progress of fish-culture and the success of the U. S. fish commission.

— The proposition to establish a national military and naval museum in Washington appears to be regarded with general favor. The plan proposed is to erect a building on the Smithsonian grounds for this purpose, the museum to be under the supervision of the Smithsonian. This plan would doubtless commend itself to congress more forcibly than would the proposition to erect a large separate building in another part of the city. The army and navy museum would be quite distinct from the other departments of the national museum, and would be placed under the control of representatives of the two services upon which it must depend for growth and development.

— The vessels belonging to the U. S. coast survey were assigned to duty last week. The Palinurus, Lieut. D. D. V. Stuart commanding, is stationed in Long Island Sound; the Eagre, Lieut. C. P. Perkins, in company with the Daisy, will proceed in a few days to the North River, to complete the work begun last year by the Palinurus. This work will take until the middle of July, when the Daisy will be employed along the shores of Staten Island. The Eagre will then begin operations in the East River at a point midway

between Hell Gate and Blackwell's Island, working by degrees through the sound until meeting with the Palinurus coming west.

— Some estimate of the signal service as a promoter of original research may be gathered from the fact that two of the three gold medals awarded by the Royal geographical society were secured by Lieutenant Greely and Sergeant Brainard, for geographical discoveries. Professor Langley was awarded the Draper medal by the National academy, for discoveries at Mount Whitney; and the Royal society of science, letters, and arts, has made Lieutenant Finley a member with its highest honors, for his original work on the subject of tornadoes, all of which was under the direction of the signal service in its legitimate duties.

— The secretary of state has forwarded to the house of representatives a letter from the American minister at Paris, enclosing an invitation to the United States to be represented at the convention of the Philomathical society of Bordeaux, France, to be held Sept. 1. The purpose of the convention is to consider all questions relating to commercial and industrial education. A letter from commissioner of labor, Wright, suggests the following gentlemen as delegates: Prof. C. M. Woodward of the St. Louis manual training school, Prof. W. P. Atkinson of the Massachusetts institute of technology, and professors from the Columbia school of mines and Stevens institute.

— Alfred Rabaud, founder and president of the Geographical society of Marseilles, died on April 12, aged fifty-eight.

— Reymond communicates some interesting notes as to the geology of the region of the great African lakes, especially of the south-east part of the Tanganyika and Nyassa basins, from specimens collected by Giraud. The region appears almost exclusively composed of primitive rocks. The only sedimentary rocks collected were from south of Tanganyika, at Yendivé station, and from Mpasa, two or three days' march from the northern end of Lake Nyassa to the north-west, on the route between the two lakes. These rocks are of a schistose character, contain Cyrena and remains of Lepidosteus, and are referred by Reymond to the upper cretaceous or lowest tertiary age. This agrees with what is known of the geology of Africa in general, where the cenomanian and nummulitic strata alone are found resting on a vast denuded plateau. The beds of brown iron ore, which cover a very large extent of country, and are worked by the natives, are supposed to have been leached out, as it were, from the crystalline rocks, by the action of the water and carbonic acid held in the vast bogs and spongy marshes of the region. One of the chief characteristics of central Africa is the absence of calcareous formations. The metallic wealth of the country, except for iron, is little known; but Giraud reports copper rather abundant between Bangweols and Luapula. In South Africa the sedimentary beds are of greater extent, and contain a considerable amount of coal of inferior quality. The collection of fresh-water and land shells made by Giraud comprises, according to Bourguignat, ninety-three species and several new forms.

— What appears to be a justifiable complaint against the delay in printing scientific reports is made by Commissioner Colman to the senators and representatives. Of the forty-five thousand copies of the first annual report of the bureau of animal industry, ordered nearly two years ago, scarcely a twentieth part have been so far delivered by the printer. Another work, Riley's report on the cotton and boll worm, long since ordered, and in the printer's hands, has not yet been delivered, though stereotyped for nearly a year.

— In a recent letter to Professor Riley, U. S. entomologist, Mr. J. Birkbeck Nevins of Liverpool gives an analysis of dried locusts from observations made by Edward Davis, president of the Liverpool literary and philosophical society, as follows: —

	Without wings.	Wings developed.
Phosphoric acid (P_2O_5)..........	1.92%	1.89%
Tribasic phosphate of lime.....	4.21%	4.13%
Nitrogen..........................	10.14%	10.64%
Ammonia.........................	12.31%	12.92%

This shows that these dried locusts are as rich in nitrogen as meat, guano, or dry blood, and contain enough phosphoric acid to greatly increase their value as a manure which English authorities estimate at about twenty-five dollars per ton.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Science at Cornell.

WILL you allow space to one who has known Cornell from the beginning, who has watched her progress with the greatest interest, and who knew personally Mr. Cornell and President White, for a few comments upon recent letters in *Science* in regard to 'Science at Cornell'?

It seems to the writer that almost every one connected with Cornell misconstrues the fundamental law. President Adams says, "It includes not simply agriculture and the mechanic arts, but," etc. President White speaks of the efforts of the trustees being "devoted to agriculture and the mechanic arts alone." When, some years ago, a committee of the legislature was appointed to investigate Cornell, and report as to the way in which the provisions of the law and the charter were being carried out, that committee was shown the machine-shops and farm, and the work of the professor of agriculture and of the professor of mechanic arts, as though these departments comprised the whole of the provision made at Cornell for fulfilling the requirements of the law. The law says, to teach *such branches of learning as relate to* agriculture and the mechanic arts. Does that mean that boys shall be taught to hoe corn, or plant potatoes, or shove a jack-plane, or swing a hammer? What are those 'branches of learning that relate to agriculture'?

Mathematics, the physical and natural sciences, drawing, mechanics, and the characteristic studies of mechanical and civil engineering, — all these 'relate to' agriculture, or the mechanic arts, or both. The law requires that the *leading object* of the institution founded under it shall be to give instruction in such branches. Will this be the 'leading object' if, as suggested by President Adams, only six hundred thousand dollars of the endowment should be devoted to this purpose? To the writer nothing can be plainer than that, to fulfil the law, whatever other endowment is accepted, whatever other branches are taught, the institutions founded upon the land-grant must make "such branches of learning as relate to agriculture and mechanic arts" (not agriculture and mechanic arts themselves) the *leading object* of instruction.

President Adams says the instruction contemplated by the law includes not simply agriculture and the mechanic arts, but other scientific and classical studies, military tactics, and the several pursuits and professions of life. This last is made to appear by quoting the last paragraph of the much-quoted passage first.

The meaning of that whole passage seems so plain, that it is strange that such diverse interpretations should be put upon it. It requires the founding of an institution whose branches of learning relating to agriculture and the mechanic arts shall be the leading object of instruction, and where other sciences and the classics may have a place, in order that the industrial classes in the several pursuits and professions of life may there receive a 'liberal and practical education.'

Can any thing be plainer than that the institution contemplated by the land-grant act should have for its leading object, whatever else it does, to provide for the instruction of the industrial class in such branches of learning as they most need in their pursuits?

Now, have the branches of learning that relate to agriculture and the mechanic arts been so well provided for that it is time to reduce expenditures in those directions for the purpose of establishing law and medical schools and what not? Large additions have been made to the material equipment of some of the departments; but not one of them can be considered fully equipped, and some have suffered in usefulness the last year from the cutting-off of appropriations. Some important branches are suffering for want of instructing-force. This is notably the case in chemistry and physics, where the number of instructors is less than for the same branches at some of the classical colleges, and much less than at some of the technical schools.

The proposition to multiply departments at Cornell seems to the writer most unwise. It is far better to take the highest rank in a few departments, if those are in the direction of the object contemplated in the foundation, than to take a lower rank in a wider field; and it is certain that the income of Cornell will need to be much larger than at present before she can take first rank in all the departments now established. A. W.

Phylloxera.

The following answers were suggested by the questions relating to the phylloxera, asked by 'A. M. D.' in the issue of *Science* for April 2, 1886.

1. Was it known as a pest in this country before its introduction abroad? The gall-type of the phylloxera was first known and described by the state entomologist of New York in 1856, seven years before the same form was known in any European country. Unmistakable evidences of its existence reach much farther back, even to 1843. In later years more or less injury was done, but the true cause of the trouble was not known until the discovery of the root-type in 1868.

2. When and how did it reach Europe? The effect of the pest was first noticed in France, by M. Pinarum, in 1863; the gall-type was described by Westwood, in England, in the same year; and the first statement of the disease in Germany followed two years later; but it remained for Prof. J. E. Plouchon to first announce, in 1868, the discovery of the root-type, and to give to it the name it now bears. During the same year the winged form was discovered, and the following year the root-type was asserted to be of the same species as the gall-type of the United States. The vineyards were noticeably diseased some time before, particularly those near some American vines which were a part of a heavy importation made in 1860, — the probable time of the introduction of the pest. Undoubtedly the pest reached France through these cuttings or stocks. The fact of transporting by cuttings is further evidenced by later experience in Germany, Switzerland, and other countries where infection began among American stocks.

3. Why is it more injurious in Europe than in its native habitat? Four reasons may be given: 1. Insects indigenous to a country are frequently kept in subjection by its enemies. Such is the case to a great extent in the Mississippi valley, where the galls of the phylloxera are often cleared of its inhabitants by depredating enemies. This restriction is removed in the new country, and the pest has full chance for development. 2. The predominating varieties of vines of Europe, and also of California, are of the kind most attractive to the root louse, while Mississippi valley produces largely gall-bearing varieties of vines, which to a greater or less extent resist the attacks of the root-louse. 3. The predominance in Europe of the most destructive type, the root-louse, against the gall-louse in the Mississippi valley, — the one attacking the roots, and affecting the vine permanently; the other attacking the foliage, and pro-

ducing only a transient effect. 4. Probably the chief cause of a comparative greater destruction can be found in the difference in soil, and more especially in the climate; that is, when European countries are compared with districts, like California, cultivating a similar variety of vine. It has been a notable feature in California experience that the spread is usually very slow, and only showing noticeable rapidity in exceptional cases. In our observations (see 'Report of college of agriculture, 1886') we have shown that a peculiar growth of roots, induced by late rains, or again by surface manuring, will produce the winged form in great abundance. But the general climate of California is extremely dry during this growing period, and therefore no such roots are apt to be formed; while in the portions of Europe where the spread has been most rapid, their type of vine being similar to that of our own, a growth of fine surface rootlets is undoubtedly induced by the summer rains, and myriads of the winged-form insects developed and spread to adjoining vineyards. The effect of fertilizing on the production of similar rootlets is doubtless greater than is usually supposed.

4. Is there any reason to suppose that the pest will be mitigated by natural causes as time goes on? As yet there seems to be no evidence in favor of such a supposition. This case should be analogous to that of other insect pests, which have been overcome only by insect enemies. This insect has been with us many years; and yet no enemy which can destroy all the forms has appeared, although the gall-type, accessible above ground, has undoubtedly been decreased in numbers by such enemies as the thrips, tyroglyphus, and others. No enemy with the needed multiplicity of forms, enabling it to traverse the vine and at the same time all parts of the roots, is known. Until such does appear, there is little doubt that the loss caused by any local disturbance will soon be replaced by the other types, and thus the species will be continued. F. W. MORSE.

Berkeley, Cal., April 22.

Topographical models or relief-maps.

I hope you will find space in your paper for the following description of a new method of making topographical models from contour maps. I compleced it a few weeks ago, and have made several models of complicated surfaces.

Make a careful tracing of the contour lines on waxed or oiled tracing-paper. Linen must not be used, as it will distort the lines when wetted. Paste the tracing on a clear piece of white holly veneer an eighth of an inch in thickness, and cut or have cut, with a fine fret-saw, the lines of contour, leaving spaces now and then, should the lines so run that the intervening wood would drop out. Fasten the veneer to a board, being sure that the surface is flat. Fasten veneer by the edges, and not through the spaces between contour lines. Cut or have cut strips of thin brass, each strip being as wide as the height of each contour line, and insert the strip into the corresponding saw-cut in the veneer. They must be pressed down until they touch the board below the veneer. When all the contours are in place, paint the whole surface over with heated wax, which will prevent the moisture of the clay from distorting the wood. When all is coated, fill in the spaces between the strips with clay until only the edges of the brass show. Where spaces are left, the strips are cut with a slanting end long enough to span the space uncut, and the line of contour is thus unbroken.

By this method nothing is left to the eye, and perfect accuracy is gained. I have made some models for Prof. N. S. Shaler, and it was at his request that I send this description to your paper.

HENRY BROOKS.

Boston, April 26.

Poison rings.

Appreciating your kindness in inserting my previous letter, containing a number of questions as to what we know of the past of the pest phylloxera, and what we may expect for its future, answers to which would certainly interest many laymen like myself, and not discouraged by the lack of response from your readers, I venture to send you this.

In the recently published volume (xx.) of the 'Encyclopaedia Britannica,' under the head of 'Ring,' it is stated that "Pliny records, that, after Crassus had stolen the gold treasure from under the throne of Capitoline Jupiter, the guardian of the shrine, to escape torture, broke the gem of his ring in his mouth, and died immediately." Hannibal is also recorded as having killed himself with his ring; and the writer further says, the "*anello della morte*, supposed to be a Venetian invention, was actually used as an easy method of murder."

Can any of your readers inform me whether any of these ancient rings are still in existence, and, if they are, how they are made, and with what poison they were filled? A. M. D.

New York, May 3.

[We publish this week a reply to 'A. M. D.'s' queries about phylloxera; and, doubtless, information as to 'poison rings' will be forthcoming. — ED.]

A swindler abroad again.

It has just come to my knowledge that the 'tramp' geologist who has been 'wandering up and down the earth' for the last three years, the man of many accomplishments and aliases, is now in the vicinity of St. Cloud, Minn., posing as 'Capt.' I. C. White of the West Virginia university.

I would say, in my own defence, that the title of 'captain' is not worn by me, and that in this case I can establish an *alibi*, with the help of my friends.

Cannot something be done to throttle this nuisance before he scandalizes every geologist in the country? Probably a committee from those whom he has swindled and misrepresented would hunt him down most successfully, and I am sure such a committee could be trusted to squelch him effectually.

I. C. WHITE.

West Virginia university, April 29.

Pompous prolixity of the French.

One reads with amused surprise, on p. 403 of the last issue of *Science*, that the literary style of French scientific writers is characterized by 'pompous prolixity.' We all understand that "that which is not clear is not good French." We had supposed that the genius of that sententious language was as much opposed to pomposity and prolixity as to obscurity.

A. G.

SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 7, 1886.

IS THE OCEAN SURFACE DEPRESSED?

I.

THE *Revue scientifique* published recently the following discussion on the communication made in January at the Sorbonne by H. Faye, upon the permanence of the earth's figure throughout geologic times. The eminent academician then affirmed that accord exists among geodesists as to the figure of our planet; that the measures of arcs of meridians already made have done away with all irregularities, which at the beginning of this century were supposed to exist; and that one can assign for the form of the surface of the sea an ellipsoid of revolution, having an eccentricity of 1: 292 (accurate to one unit in the denominator).

I do not feel able to say how the assertions of M. Faye can be reconciled with the diametrically opposite ideas which have been developed in recent German works, noticeably in the 'Lehrbuch der geophysik' of Günther, the works published in 1868 by P. H. Fischer, in 1873 and 1877 by Listing, and, above all, in the important memoir which Bruns published at Berlin in 1876; which last is not even mentioned by the learned French astronomer. I can only call attention to his estimation of their value, without being able to judge of the reasons which have determined it. I must leave this to the geodesists.

I would say the same thing of another assertion of M. Faye, — that relative to the constancy of the force of gravitation at the surface of the sea along the same parallel. "Navigators," says he, "have carried the pendulum at the surface of the sea over a large portion of the earth, and in both hemispheres, without the pendulum indicating the least diminution of the force of gravity ascribable to depression of the earth's crust." Now, Fischer, as well as Hann, states, that, upon the islands situated in the open ocean, the pendulum, when swung at the surface of the sea, executes at least nine and one-third more oscillations than upon the shores of the large continents. This, at the rate of one hundred and twenty metres for one oscillation, gives more than a thousand metres for the depression of the sea at the centre of the oceans; and this same conclusion is elaborated also by Listing as well as by Pinck. So startling is this disagreement, that we acknowledge that it is almost beyond credence; and, as attention has been called to it, proper experiments should be undertaken to clear away all doubts.

But, even if we admit the correctness of the data given by M. Faye, there is one point in his theory which we cannot pass over, because it touches the constitution of the earth's crust. The eminent academician reasons somewhat in this way: at any point over the sea, the density of the water being sensibly inferior to that of rocks, there should be a local diminution of the attracting mass, and consequently the pendulum ought to oscillate less rapidly. Since this is not the result, there must be some cause counteracting the diminution of the superficial mass. This cause, according to M. Faye, can only be an increase of the density of the crust. As the solid rocks have in general a density greater than that of the molten materials from which they are obtained, and if under the sea the solidification has progressed farther than under the continents, the increase of the solid mass under the seas could compensate the diminution of density resulting from the column of sea-water above. But to this conclusion I am not ready to assent.

If it be true that a majority of bodies are more dense in the solid condition than in the liquid, it is also true that we know very little of the physical condition of the interior of the earth. Even in our day many *savants* hold that the earth is entirely solid. But, admitting the existence of a liquid interior covered by a solid crust, how can we assert that this crust, traversed by numerous crevasses, does not contain sufficient open spaces to annul the slight increase of density due to solidification.

Let us accept Faye's hypothesis for the time being, and search with him for the cause which has produced this increase of solidification. We know, from the submarine investigations of the last few years, that everywhere on the bottom of the large oceans there reigns a temperature in the neighborhood of 0° C. The cause of this is to-day well known. The water of the polar regions, rendered denser by cooling, sinks, and, following the bottom of the sea, tends to replace the water evaporated in the tropical regions. M. Faye says this cause for the cooling of the bed of the oceans has existed ever since there have been ice-caps at the poles, and that it is impossible that such an action, prolonged through a sufficiently long period, should not have affected the temperature

of the earth's crust beneath. This is the principle of his hypothesis, but it is not sufficient to announce it. It is also necessary to justify it in proving that the cause is adequate to the effect. This it is that M. Faye has neglected to do; and I would add, that, in my conviction, such a proof is impossible.

But, before attempting to show this, it would be well, perhaps, to call attention to one singular consequence, which is entailed if it is necessary to admit the theory of the cooling of the earth's crust by contact. No one is ignorant of the fact, that, if the temperature of the bottom of the sea is in the neighborhood of 0°, there are on the surface of the continents wide stretches of country which are still less favored. Without speaking of mountainous regions covered with perpetual snow, we will only mention the plains of Siberia, and especially that of the district of Yakootsk, where there reigns a mean temperature of — 10°C. This temperature, as may be readily seen, was established at the same time as the ice-caps around the poles, and has tended to produce a change of temperature of the crust for a time at least as long as that during which the cold waters have flowed over the ocean-bottoms: consequently, as the earth's surface affected by this cooling is far from being negligible, it is there that the pendulum ought to oscillate the most rapidly.

But, aside from this argument from the facts in the case, there are other strong reasons deduced from what we know of the bad conductive power of rocks. Experiments at Paris have shown that a change in the mean monthly temperature propagates itself in thirty-eight days to the depth of one metre, and that at ten metres below the surface all variation in the temperature of the air becomes absolutely insensible. This being the case, one would think that a cooling coming from the surface could hardly exercise any effect on the inside of the crust of the earth.

To argue the possibility of such a cooling effect, it would be necessary first to have some idea of the probable thickness of the crust. Whatever hypothesis we accept as to the interior constitution of the earth, it is inadmissible that, at the time when the glaciers took possession of the poles, the thickness of the solid crust had not reached at least twenty kilometres. Fossil botany teaches us that in the middle of the tertiary period the regions immediately around the poles possessed a rich vegetation of a character essentially temperate, which certainly could not have existed in the neighborhood of ice. The first appearance of polar ice was therefore not in the carboniferous period, when we know, moreover, that the arctic seas were inhabited by corals like those which now live only in the tropics. This granted, if we take account of the generally given thickness of the gneiss and micaschists, by all estimated at many thousands of metres; if we add to this the Cambrian, Silurian, Devonian, and carboniferous deposits, even attributing to them only a small part of the depth which they have in Europe, — we find that a total thickness of twenty thousand metres for the crust constitutes certainly a moderate valuation.

Let us suppose, then, a crust of twenty thousand metres, of which the temperature, about 2000° C. on its lower side, decreases regularly up to the surface, where it is about 20° C., — the minimum of tropical regions, — or a diminution of one degree for ten metres. Can we imagine a difference of twenty degrees in the surface temperature could have produced an appreciable difference in the interior even after millions of years?

Let us consider more closely in what way the distribution of temperature exists in the interior of the earth. We know that this temperature increases constantly with the depth. But it has long been granted that the flow of heat does not contribute to the exterior temperature more than the thirtieth of a degree. Let us reverse the calculation, and ask how far a temperature of 0° C. could contribute to the diminution of heat which reigns at twenty kilometres depth. Cannot the answer be made without discussion?

But we have the reply expressed in figures in the results of some investigations in Siberia. In 1836 a merchant of Yakootsk, wishing to utilize the internal heat, dug a well in the hope of reaching water. In this well, dug to a depth of 115 metres, the temperature increased progressively from — 10° C. to 0° C.

The well was abandoned because such a great depth rendered it useless for the purpose proposed; but a little later, in the steppes of Katchongin, another well reached water at a depth of 126 metres. Therefore, below the constantly frozen surface of Siberia, the temperature rises in 126 metres at least ten degrees to 0° C. The increase is thus one degree for twelve metres and a half; that is to say, three times more rapidly than in the temperate regions, where it is one degree for from thirty-five to thirty-seven metres.

What, therefore, is to be concluded? Even that a great superficial cold only affects the layers immediately in the neighborhood of the surface, and that this influence at any considerable depth must become absolutely insignificant. If, then, the force of gravitation is not diminished above the oceans; if at the same time, on the authority of all others with the exception of M. Faye, there exists a sensible increase, — it is not to an increase

in the density of the crust that this result can be attributed. The only admissible explanation is a diminished distance to the attracting centre, and consequently a deformation of the ellipsoidal surface of the sea.

Hence I express my desire for further measures of great circles, following the suggestions of Bruns, the astronomical and geodetic observations to be combined with the most precise levellings and with measures of the force of gravity. Then only could the question be decided in a definite manner. Up to that time it is premature to wish to attack it, either by hypothesis in discord with the laws of science, or in passing over in silence the work, which, true or false, merits at least a respectful examination. A. DE LAPPARENT.

II.

M. DE LAPPARENT'S high authority as a geologist renders it my duty to give certain explanations in support of the partly geological theory which I have recently presented.

First, as regards the figure of the earth, it is not a question of authority taken second or third hand. The measurements of arcs of meridians are well known; and the calculation which permits us to conclude from these measurements the figure of the earth is very simple, and may be verified by any one.

The surface of the earth conforms so well in all parts with an ellipsoid of revolution, that the deviations are absolutely unappreciable, save by the most delicate measurements.

As regards the pendulum, with which the most recent measurements have been made by Mr. Clark of England, and in the United States by Mr. Peirce, the results are no less striking. These two reach by the same method of observation, wholly independent of the measurements of arc, and by calculations easily verified, the same flattening, 1:292.

It is very true, as M. de Lapparent has remarked, that, among the numerous observations made in all parts of the earth, those which have been made on the small isolated islands in the middle of the ocean have indicated a force of gravity a little too strong; but these slight anomalies do not vitiate the general result, that is to say, the value of flattening above given.

This fact has been known for seventy years, but it has been wrongly interpreted. Some have laid the blame upon the observers. Others have said, that, as the islands were of volcanic origin, the materials composing them have a greater density, which would account for the excess of local attraction. Others, fifty years ago, have said, what M. de Lapparent repeats to-day, that, if the force of gravity is a little greater on the islands, it is because the surface of the sea is nearer the centre of the earth.

The true interpretation is less pretentious, and does not contradict assured scientific facts. It is simply that it has been forgotten to take into account the excess of attraction of the submerged mountains, at the summit of which observations were made, over the attraction of an equal volume of water, which it replaces in the middle of the sea. Unfortunately the navigators have not thought to determine by suitable soundings the form of the submarine pedestal on which their instrument was placed, so that it is impossible to-day to apply the necessary corrections to their results.

Finally, the chief argument of my opponent is the poor conductibility of the rocks which compose the earth's crust. I will say first, that, despite this feeble conductibility, the earth has become sufficiently cool in the course of the geologic ages to have acquired a solid crust of from thirty thousand to forty thousand metres in thickness. It follows, then, that the central heat traverses this thick crust, notwithstanding its slight conducting-power, to finally lose itself by radiation in space. I am unable to see that this undoubted cooling operates everywhere under the same conditions. Leave aside the argument of Siberia, and consider a spherical surface a league or a league and a half below the surface of the earth. At this depth it is necessary to distinguish two regions, — one situated beneath the continents, and the other found in the depths of the ocean. The central heat which arrives at this surface in the first region must still traverse an enormous bed of rock before it can radiate into space. Precisely on account of the slight conductibility of this highly protecting thickness of rock, very little heat passes; and there beneath our feet, at this depth, the central heat makes itself strongly felt, the temperature rising to more than 200° C. In the other region — the submarine region — the case is different. There the superincumbent bed, of a league and a half in thickness, is water; but water is an excellent transporter of heat when received from the bottom, the water carrying the heat upward, not by conduction so much as by the ascending currents, to which the least accession of heat gives rise. Thus the central heat passes easily in such a region. Moreover, the continual flowing-in of polar water at a temperature of — 1° or — 2° aids the refrigeration.

It therefore seems to me evident that the cooling of the central mass is facilitated by the sea, and

obstructed by the continents. Is it necessary to add that the waters of the ocean, under a pressure of from four hundred to six hundred atmospheres, penetrate deeply into the solid beds upon which the ocean rests, and render these beds more permeable to the heat? It is reasonable, and in no wise contrary to the laws of physics, to conclude that the cooling of our globe, elsewhere excessively slow, has progressed more rapidly and more deeply under the seas than under the continents. This difference has existed for many million years, and ought to have caused in that extent of time a notable variation of thickness in the solid crust. H. FAYE.

BACTERIA AND DISEASE.

DR. GEORGE M. STERNBERG, U.S.A., so well known as a writer and investigator in bacteriology, delivered a lecture before the Alumni association of the Long Island college hospital, Brooklyn, on the evening of April 20. The subject upon which he was requested to address the association was, "A general review of the relation of bacteria to disease, including an account of a personal observation of Pasteur's methods in the prevention of hydrophobia, and their results."

The lecturer called attention to the frequent references of late to the labors of Pasteur in his inoculations for hydrophobia. While some of these willingly accorded to Pasteur all the honor he deserved, there were others which criticised adversely not only his methods, but even his professional reputation, charging him with acting the charlatan in keeping his methods secret. It is true that Pasteur has not proclaimed his experiments abroad in all their details; but this is not because he desired to keep them secret, but because he wished to satisfy himself that his methods were right before he encouraged others to undertake them. In this respect he has done what every scientific man would do. He has, however, always been ready to explain to those whom he regarded as competent his method, and even to demonstrate it to them.

The basis of Pasteur's method depending on increase in the virulence of the virus by transmission through a number of rabbits, and its use in gradually increasing potency in inoculation, has already been described in *Science;* and his system of protecting inoculation is too well known to call for further mention at this place.

Before Pasteur inoculated any human beings, he had tested his method upon fifty dogs, and had in every case rendered them immune, that is, insusceptible to hydrophobia. The history of the first person inoculated, Joseph Meister, is too well known to need repetition here. Since this time (July, 1885), Pasteur has inoculated three hundred and fifty persons. Of course, Pasteur knows as well as any of his adverse critics that all these persons were not bitten by rabid dogs, but he could not refuse to inoculate them. With the exception of the Russians who have recently died, Pasteur has had but one unsuccessful result. In these cases the explanation is probably to be found in the fact that the inoculation was practised too late. It is just so in vaccination, which is recognized as a preventive of small-pox. If we can vaccinate in time, we may abort an attack of small-pox which would otherwise occur; while, if our vaccination is done at the close of the incubatory stage of the small-pox, it will be of no avail.

Dr. Sternberg read a translation of Pasteur's last communication to the French academy, published in the *Comptes rendus* of March 1. In this paper Pasteur gives the results of his inoculations, showing indubitably that the individuals operated upon had in most instances been bitten by rabid animals. These persons had come to him with certificates from medical men and veterinarians, showing this fact beyond a doubt. In speaking of his one apparent failure, Pasteur says that the child was not brought to him until thirty-seven days after the bite was received, and that the wounds in the axilla and the head were in themselves most serious, and that but for the sake of humanity he would have refused to treat the child for the hydrophobia.

Pasteur gives it as his opinion that one death from hydrophobia occurs in every six persons bitten, and that the disease is most apt to occur within forty or sixty days. Of the persons treated by him, one hundred were bitten more than seventy-five days before the publication of his communication, and were still well; another hundred had passed for six weeks to two months; and the others were still well, and time only could tell what would be the result in their cases.

In concluding his remarks upon hydrophobia and the methods of Pasteur, Dr. Sternberg said that the only criticism which suggests itself with reference to this interesting statement of facts is that Pasteur does not attach as much importance to the prophylactic value of early and thorough cauterization as this measure seems entitled to. The considerable number of cases in which cauterization was practised may have had a greater influence upon the favorable result in the extended series of cases reported than Pasteur has been willing to admit. At all events, it will be well to withhold our final judgment as to the value of the method as applied to man until the three hundred and fifty cases reported are all beyond

Fig. 1.—Composite from photographs.

Fig. 2—Composite from direct sittings.

Fig. 3.—Ruling face in fig. 1.

Fig. 4.—Ruling face in fig. 2.

COMPOSITE PORTRAITS OF THREE DAKOTA WOMEN, SHOWING THE EFFECT OF THE METHOD OF PRODUCTION.

the limits of time within which the disease may develop, and especially until we have from Pasteur a satisfactory explanation of the failure in the cases of the three wolf-bitten Russians who have recently died of hydrophobia after having submitted to his treatment.

In discussing the relation of bacteria to disease, the lecturer stated, that, in response to a question of his, Pasteur had told him, that, although careful and persistent search had been made, no organism had been found in the hydrophobic virus, and that no difference could be detected between virulent and non-virulent spinal cords. An investigator in Geneva has recently claimed to have discovered the germ of rabies, but the claim lacks confirmation.

In contagious pleuro-pneumonia no germ has yet been discovered which can be considered as the specific micro-organism of the disease. Sternberg, Councilman, and Welch have lately been at work at the problem, but have as yet been unsuccessful.

In the pus of acute abscesses micrococci are invariably found. That the bacillus of anthrax, the spirochaeta of relapsing-fever, the bacillus of tuberculosis, all stand in an etiological relation to those diseases, there now seems to be no doubt. The dispute between the Germans and the English, as to the *rôle* played by the cholera bacillus in the production of that disease, is still unsettled. The bacillus of typhoid-fever, discovered by Ebert in 1880, is claimed by Koch to be the undoubted germ of that disease. His assistant, Gaffky, invariably finds it in the spleen of those who have died from the fever. Koch thinks that it forms spores. When introduced into the circulation of lower animals, it does not produce typhoid; but nothing can be argued from this, as we do not know that this disease ever affects animals other than man.

ACCURATE MOUNTAIN HEIGHTS.[1]

OF the various methods of determining the height of a mountain, the best is undoubtedly that of running a line of levels to its summit. This method is accepted as the standard, and as that by which the errors of the other methods are to be judged. A surprising degree of accuracy can be attained in levelling an ordinary country. Many of the errors compensate, and the final results should generally be accurate within a small fraction of a foot. In ascending a mountain, much greater deviations must be expected. The back sights are usually longer than the fore sights, and therefore errors in the adjustment of the level or in the correction for atmospheric refraction are cumulative. The effect of the mass of the mountain on the level would produce an error which would not be compensated, and might be large enough to be appreciable. Finally, an error in the length of the levelling-rod would enter to its full proportionate amount. For these reasons much reliance should not be placed upon the fractions of a foot, unless the above sources of error have been considered and proper corrections applied. The precise heights as determined have, however, been given below. The labor and cost prevent its general application to the determination of mountain heights. A few lines of level have been run up the hills and mountains in this portion of the country [New England], generally by the enterprise and enthusiasm of volunteers. A description of several of these has been collected from various sources, in most cases from the local newspapers. The principal results are published below for permanent reference. Doubtless many similar measurements have been made, and it is hoped that they may be communicated to the writer as material for a second paper. As an example of the danger that such material may be totally lost, it may be mentioned that scarcely any of the results given below are contained in the excellent 'Dictionary of altitudes of the United States,' recently published by the U. S. geological survey.

The following table contains a number for reference, the name of the mountain or other object measured, and its height above the mean tide-level of the ocean. Additional information regarding many of these points is contained in the original article in *Appalachia*. Nos. 1 to 10 are taken from 'The geology of New Hampshire,' vol. i.; Nos. 11 to 17, from an article by Mr. J. J. Holbrook, *New Hampshire Sentinel*, Nov. 22, 1877, where the altitudes of several other points in Cheshire county, N.H., are also given. All of these stations are in New Hampshire; Nos. 18 to 43 are in Vermont, and Nos. 44 to 63 in New York.

STATIONS.	FEET.
1.. Mount Washington	6,293.000
2.. Upper water-tank, Mount Washington railroad	5,800 000
3.. Second tank (Jacob's Ladder)	5,468.000
4.. Waumbek Junction	3,910.000
5.. Ammonoosuc Station	2,668.000
6.. Halfway House	3,840.000
7.. Glen House	1,632.000
8.. Kearsarge (S.)	2,942.790
9.. " Garden	2,622.500
10.. " Plumbago Point	1,705.000
11.. Monadnock	3,169.300
12.. " Mountain House	2,071.964
13.. John Mann's, near divide	1,487.602
14.. Jaffrey Schoolhouse No. 12 (threshold)	1,231.227
15.. Troy Schoolhouse No. 3 (lowest step)	1,166.112
16.. Beech Hill	1,060.566

[1] From *Appalachia*, iv. 215.

STATIONS.	FEET.
17..Beech Hill Reservoir	594.589
18..Mount Mansfield (chin)	4,389.080
19.. (nose)	4,056.390
20..Summit House.	3,841.640
21..Ridge south-east of Summit House	3,612.380
22..Halfway House.	2,306.380
23..Junction of Notch Road	1,291.350
24..Bench near J Houston's.	955.050
25..Mansfield House, Stowe	720.270
26..Methodist Church, Waterbury Centre	712.530
27..Killington Peak	4,220.870
28..Summit of the second ridge.	3,546.310
29..Rock, summit of the first ridge	3,335.480
30..Bench, rock near Manley's barn	2 097.610
31..Bench, rock near R. Maxham's	1,312.720
32..Junction of the mountain road, Sherburne.	1,504.770
33..Hotel, Sherburne	1,211.210
34..Congregational Church, Bridgewater	892.390
35..Mount Tom (north peak) Woodstock	1,351.220
36.. (south peak) "	1,244.120
37..Little Killington	3,951.000
38..Base of the town hall, Woodstock	697.690
39..Pico	3,935.000
40..Shrewsbury Mountain	3,707.000
41.. " Peak	3,838.000
42..Camel's Hump	4,077.000
43..Ascutney	3,168.000
44..Whiteface Mountain	4,871.655
45.. " " (spring)	2,817.958
46.. " " (brook, second crossing on trail)	2,023.965
47..Whiteface Mountain (brook, first crossing on trail).	1,959.996
48..Lake Placid.	1,863.715
49..Mount Marcy	5,344.243
50.. " " (hump)	4,998.278
51..Lake Tear of the Clouds	4,321.958
52.. " " " " (summit of notch)	4,355.318
53..Panther Gorge	3,353.687
54. Mount MacIntyre	5,112.730
55..Mackenzie Pond Mountain	3,789.322
56. Mount Skylight	4,889.626
57. Gray Peak	4,902.000
58..Haystack	4,918.626
59..Bartlett (west shoulder)	2,785.512
60..St. Regis Mountain	2,888.298
61..Lyon Mountain	3,809.000
62..St. Regis Lake (lower)	1,623.162
63..Raquette Lake	1,774.349

The height of Mount Washington was determined in 1858 by Captain Cram of the U. S. coast survey. Nos. 8 to 10 are from the carriage-road survey by Mr. R. S. Howe. Nos. 11 to 17 were levelled by Mr. J. J. Holbrook and Nos. 18 to 26, by Mr. Hosea Doton, who started from the railway station at Waterbury, and assumed the height of the top of the sleepers at that point to be 425 feet. Nos. 27 to 37 were determined in 1863 by Mr. Doton, who ran a line of levels, starting from White River Junction. The height of White River Junction was assumed to be 351 feet. Nos. 38 to 41 were determined trigonometrically from No. 27. No. 42 was levelled by Mr. Charles Collins at the time of the building of the Vermont central railroad and No. 43, by Messrs. H. F. Dunham and D. C. Bell, from a bench in Harland. The bench appears to have been the summit of Garvin Hill. Nos. 44 to 63 are taken from the 'Seventh report of the Adirondack survey,' by Mr. Verplanck Colvin. No. 61 was not determined by levelling, but from the mean of two months' observation with the barometer.

E. C. PICKERING.

PROPOSED NEW TRADE OUTLET ON THE BLACK SEA.

THE Russian government has very recently, says *Engineering*, partially approved of a new scheme for doing away completely with commerce at Sebastopol, and diverting the stream of trade to Theodosia, at the eastern extremity of the Crimea. To achieve this it is projected to construct a railway some eighty miles in length, from the Djanski station of the Lozova-Sebastopol line, and build a regular port at the Theodosian extremity. Of course, the building of the railway and port will be an expensive business, to say nothing of the inconvenience and loss incurred by the numerous merchants and trades-people, who will be compelled *bon gré mal gré* to transfer their operations from Sebastopol to Theodosia. But the Russian government never allows commerce to interfere with its military and naval plans; and certain high authorities having advocated the conversion of Sebastopol into a naval station, pure and simple, there is a probability that the rapidly increasing trade of the port will be summarily shifted to the other end of the Crimea. Such a despotic transfer is very little relished by the business-people of Sebastopol, to whom is really due the credit of having restored the place from a mass of ruins to a respectable town, and who have no inclination to have to repeat the process amidst the broken relics of Genoese, Turkish, and early Russian rule at Theodosia. Moreover the port is a very inferior one compared with Sebastopol, being quite open to the sea and although Chardin, when he visited the place two centuries ago, stated that there were more than 4,000 houses and 80,000 people in Theodosia, and 400 ships in the bay it is not easy to believe that it was a very commodious port for shipping. In ancient times Theodosia was called Kaffa, and is reported by classic writers to have shipped as much as 3,000,000 bushels of wheat in one year, serving during the period in question as the 'granary of Greece.' In later times the Genoese did a large trade here; but the Turks knocked the place to pieces when they took it from the Genoese, the Russians again when they seized it from the Turks and finally Hobart Pacha bombarded it in 1878. The population is about 10,000 souls, housed in hovels amidst a vast

expanse of ruins, and the town is about one of the dirtiest on the Russian shores of the Black Sea. Should the government carry out its plan, Kaffa will doubtless recover a deal of its ancient prosperity, but considerable time will be needed; and, in the financial condition of Russia, it is curious the government should burden itself with such an onerous task.

TOPOGRAPHICAL MAPS OF THE UNITED STATES.

A NUMBER of sheets of the topographic map of the country in preparation by the geological survey have lately been issued, and give good promise of the future. As to their accuracy it is impossible for any one person to speak, inasmuch as they come from many parts of the country; but, so far as they represent regions that the writer has chanced to visit, they give a satisfactory and characteristic illustration of their geography, and there can be little question that they will meet with general approval on this score. In regard to execution, they deserve hearty praise, as being decided improvements over certain maps previously issued. The sheets are about eighteen and one-half inches long by thirteen to fifteen inches wide, varying in the latter measure according to their latitude. Each one is bounded by even degrees or half-degrees, and is printed in three colors. The relief is indicated by brown contour lines for every fifty feet in the states, where the scale is 1 : 125,000, and for every two hundred and fifty feet in the western territories, where the scale is 1 : 250,000. The streams and lakes are in blue. The roads, towns, boundaries, and lettering are in black: the latter gives the name of the survey and that of the state or territory, and a special name for the sheet, at the top; latitude and longitude (from Greenwich), on the margins; scales, date of work, and names of persons or surveys in charge of the district, at the bottom; and names of counties, townships, towns, streams, etc., on the map itself. The mechanical execution of all this work is neat, clean, and accurate; and it is with a feeling of great satisfaction that we greet the appearance of so welcome an addition to our scanty store of these civilizing agents. We have as yet received no information as to the cost of the maps per sheet, but presume that they can be obtained singly and at moderate price; so that eventually — and not too far in the future — we may all have good maps of the region about us. The present edition contains several sheets for Montana, constructed from data received from the late Northern transcontinental survey; a good number for Utah, with two for Arizona and Nevada, from work under the old Hayden, Wheeler, King, and Powell surveys, whose records are now, happily, thus consolidated: and a few others for Missouri, Texas, and Alabama, surveyed two years ago under the present organization. These last are especially interesting as revealing to us the topography of regions that have had too little attention during the last two decades of rapid western exploration.

THE COUNTRY BANKER.

MR. RAE'S book consists of a series of informal talks about the business of an English country banker. There is hardly any thing about the general theory of banking, and little that is directly of value to the economist or student. The author simply gives a great quantity of practical advice to bank managers in the smaller towns of England, — whom they ought to give credit to, what securities to take, how to treat customers and clerks; and so on. The advice is confined exclusively to the particular audience he is addressing. Nothing is said about the practice and business of other kinds of banks; not even of the large London banks, except incidentally by way of contrasting their operations with those of country banks.

A great deal of the advice given is such as any shrewd and sensible man would give in any profession. The country banker is to be careful and circumspect, to watch his customers and his securities, to keep a good reserve, not to give too high salaries and yet to give sufficient salaries; and so on. It is not easy to see how such advice can be of much use to the persons to whom it is addressed. Rules of this kind are obvious enough: the difficulty is to apply them. Occasionally Mr. Rae gives something more concrete, as where he discusses the goodness of various kinds of securities, and the inferences to be drawn from a business-man's balance-sheet; and in these places bankers and money-lenders may find useful hints. But in the main one suspects the book will prove entertaining to that large class to whom banking and finance are an attractive mystery,— the people to whom a discussion of money and money-making and money-lending, and the handling of financial matters, has a fascination like that of the big bars of solid gold to the sight-seers at the mint. And to such persons, as well as to the general reader who wants to know something of the routine of banking, the book can be recommended. It is sound, sensible, and clearly and fluently written.

The country banker. By GEORGE RAE. With a preface by Brayton Ives. New York, *Scribner*, 1886. 12°.

Incidentally one gets interesting glimpses of English habits. Thus the habit of cutting bank-notes in two, and transmitting the two halves in separate envelopes by post, — to guard against loss or theft in transmission, — still exists. Mr. Rae advises managers not to issue notes to "any one who, you have reason to suspect, would straightway cut them in halves, and despatch them by the first post as a remittance to London." And notes of local country banks are sometimes preferred by people in rural parts to Bank-of-England notes. Ignorance and prejudice of this kind on monetary matters are possible only in a rather stolid and slow-moving community like that of rural England. Again, the country banks handle deposits in a way differing from methods in this country. They charge an eighth of one per cent on all transactions, whether of money deposited or checks cashed. On the other hand, they allow to depositors interest on their accounts from day to day, at the rate of from two to two and one-half per cent. No such practice, we believe, exists in London or in this country. The expense of handling an account, and the gain from deposits, are allowed to offset each other,— a rough-and-ready but simple process. The more punctilious arrangement of the English country banks is characteristic of their general business habits.

F. W. TAUSSIG.

PHILOSOPHICAL QUESTIONS OF THE DAY.

THE reader who has no previous acquaintance with Von Hartmann cannot be advised to begin with this volume; but whoever has a moderately good knowledge of the great pessimist's views and methods will find these brief essays both instructive and amusing. Von Hartmann here uses all his well-known dialectic arts, sets his various opponents to fighting among themselves with all his old, somewhat trite but always charming ingenuity, parades for the reader's benefit a large part of his imposing and finely drilled terminology, and retells in his pleasing way much of his philosophical romance. The tireless activity, the immense reading, the skilful writing, and the attractive personality of the author are all freely displayed. Nobody else in this generation can do what Von Hartmann has done: so much is clear. Nobody else can make both pessimism and abstract metaphysic so popular; nobody else can join such a talent for advertising with such a genuine speculative genius; and to nobody else has Heaven granted such various talents, literary, commercial, scientific, journalistic, philosophical, and quasi-philosophical. Whether the result of the use made of these powers in Von Hartmann's case has been to produce a philosophy, every reader must judge for himself as he can. For our part, we can make nothing of the outcome, in so far at least as it is Von Hartmann's. His stubborn insistence upon giving to his account of the absolute the form of an historical romance is his most characteristic and fundamental philosophical blunder. One cannot regard even elementary geometry as a story: its truths are contemporaneous. How much less, then, can an incoherent narrative, such as Von Hartmann gives of the 'weltprocess,' exhaust or even fairly begin an exposition of the philosophy of the absolute, in case, namely, there is any philosophy of the absolute possible at all? And as for Von Hartmann's pessimism, this whole conception of a balance-sheet of pleasures and pains as a test of the value of life seems to us unpsychological, and opposed alike to the common sense of mankind and to the demands of speculative thought upon ethical problems. Deeper truth there indeed is in Von Hartmann's writings, and much of it: but, so far as our knowledge of his works goes, this deeper truth represents rather the common property of idealists than any creation of Von Hartmann's. But one thing, at least, must be admitted by the unkindest of critics; viz., that if there is in Von Hartmann, as we must hold, only the spoiling of a philosopher, our pessimist still remains one of the best philosophers ever so completely spoiled.

Philosophische fragen der gegenwart. Von EDWARD VON HARTMANN. Leipzig und Berlin, *Friedrich*, 1885. 8°.

Of the twelve essays in this volume, all brief and all interesting, the most valuable, to our mind, are the first, 'Die schicksale meiner philosophie in ihrem ersten jahrzent;' the fourth, 'Uebersicht der wichtigsten philosophischen standpunkte;' the fifth, 'Zur pessimismus-frage;' the sixth, 'Zur religions-philosophie;' the tenth, 'Die grundbegriffe der rechtsphilosophie;' and the eleventh, 'Kant und die heutige erkenntniss-theorie.' Of these, the first is by far the most directly and universally attractive, because it brings Von Hartmann's personality to the front most of all, and is a fine example of his frequently used device of joining the methods of autobiography with those of metaphysic, to the great advantage of the general reader, if not to the advantage of his philosophy itself.

JOSIAH ROYCE.

THERE have been but sixty cases of death from hydrophobia in Philadelphia during the past twenty-five years, the largest number, seven, occurring in 1869.

SCIENCE.

FRIDAY, MAY 14, 1886.

COMMENT AND CRITICISM.

A VERY IMPORTANT contribution to the discussions which are now in progress with respect to the scientific work of the United States government has reached us within the last week. It is a voluminous report of the testimony elicited by the joint congressional commission, of which Senator Allison is chairman, from the time when it began to act, Dec. 4, 1884, until Jan. 30, 1886. This evidence was presented in the senate on the 16th of last March, and ordered to be printed. It constitutes a book of more than eleven hundred pages, in which a very copious and well-arranged index is included. The first portion of this volume, including the evidence which was collected during the first winter of the commission's service, has long been in type, and has been the basis of some of our previous comments. The latter half, including the testimony taken last December and January, is new to us, and to that alone we now call attention. In the *personnel* two changes were made at the beginning of last winter: Senator Morgan took the place of Senator Pendleton; and Mr. John T. Wait, a representative for Connecticut, the place of Mr. Theodore Lyman, a representative for Massachusetts. Fourteen sessions were held during the two months just named, and the principal officers of the coast survey, the geological survey, the hydrographic survey, and the signal service, were examined. In addition to their testimony, communications are also printed from Simon Newcomb and Alexander Agassiz.

In a somewhat rapid examination of this volume, we discover a vast amount of detailed information in respect to the conduct of scientific work by the government, but we do not perceive any fresh contribution to the discussion of the principles which should govern the organizations. There is nothing to indicate the conclusions of the commission, though the bias of individual members may be surmised from their interrogations. It would appear as if the commission had pursued their inquiry with fairness and thoroughness, and with a sincere desire to set before congress the exact condition of affairs. It is a pity that some competent person had not been employed to digest the information thus laboriously collected, and to present in a colorless summary the suggestions which are made, *pro* and *con*, as to possible changes. Professor Newcomb (Jan. 15, 1886) succinctly describes the situation from his point of view, pointing to "the want of adequate administrative supervision of the work of those bureaus," and declaring that he sees but one remedy, — "to place all the scientific work of the government properly so called under a single administrative head, to be selected by the President." The remarks of Professor Agassiz discriminate between the work which legitimately belongs to the government and that which does not; and he refers (Dec. 2, 1885) to a note which he has written to the *Nation*, embodying his ideas in regard to all this government business.

Major Powell, in a letter to the commission, has presented some criticisms of the changes proposed. He says "that the bill [brought before congress by Mr. Herbert], in prohibiting the expenditure of any money for paleontological work or publication, except for the collection, classification, and proper care of fossils and other material," practically provides for exactly the paleontological work now being prosecuted by the survey, but prohibits its publication. He also calls attention to the popular misunderstanding of the scientific conception of a theory. The bill prohibits "the general discussion of the geological theories." If this is used in the scientific sense, it prohibits any classification, or suggestion of the possible co-ordination, of the recorded facts. In view of the absolute necessity of the geological survey prosecuting all branches of research which can in any way bear upon the knowledge sought, it would be more reasonable for congress to provide for curtailing the expenses of the bureau, causing the depletion to fall upon the entire organization, rather than to commit the error of lopping off some branch or branches of the work.

THE QUESTION OF THE PLACE and character of the moral and religious instruction at Harvard

was officially settled by the board of overseers last week. The subject has excited great interest, because Harvard is generally looked to as the leader in the matter of higher education in this country; and it was pretty generally felt that whatever course Harvard should take in this regard would be quite generally followed, in the course of time, by other institutions of learning. Pending the settlement of the question, — and it was one which a conscientious president or overseer could not settle in a day, — the Harvard authorities and one or two of the professors have been subjected in some quarters to a criticism which was as unnecessary as ill-timed. A deliberative body of any force of character is not to be deterred from doing its duty as it sees it, by the noisy clamor and abuse of *ex-parte* advocates. The subject is now settled, and it will give general satisfaction when it is known that the guiding principle of the solution found is unsectarian Christianity. Whether this will be found possible of attainment in practice is a question, but the overseers have provided for it as best they could. Rev. Francis S. Peabody becomes Plummer professor of Christian morals, and head of the department of religious instruction in the college. He will also be the university pastor. As coadjutors, Professor Peabody is to have five college preachers, who are to be clergymen of reputation and large experience. These college preachers will, with the professor, have charge of the chapel services and of the religious instruction. As we understand the scheme, each college preacher is appointed for a year, but fulfils the duties of his position only one-fifth of the time. In this way a constant succession of able clergymen of various denominations will be in co-operation with Professor Peabody. In theory this plan seems excellent, but we shall await its practical application with interest and not a little incredulity.

THAT SCIENTIFIC MEN believe that the claim of Pasteur has merit enough to entitle it to investigation, if not to credence, is evidenced by the fact that commissions are being sent to Paris to examine into the methods now practised for the prevention of rabies. The English government has appointed such a commission, having selected some of the most eminent men in the kingdom. Sir James Paget, T. Lauder Brunton, Sir Henry Roscoe, and Burdon Sanderson are names which will satisfy every one that justice and caution will be exercised in the inquiry. Germany, by the selection of Virchow and Koch, has shown her interest in the matter. The Academy of medicine of Rome has sent delegates for the same purpose; while the Archduke Charles Theodore of Bavaria, a physician, has started for Paris to make an investigation on his own account. It would seem reasonable to expect some decided results from an investigation made by such talented men as most of them are known to be, and that the truth or falsity of Pasteur's claim was in a fair way to be established beyond a peradventure.

IT IS TO BE HOPED that congress will not fail to pass the bill authorizing the appointment of a commission to inquire into the merits of inoculation for the prevention of yellow-fever. This bill was introduced at the instance of Dr. Joseph Holt of New Orleans, and has received the indorsement of the American public health association. From the daily press we learn that the physicians of the military garrison at Vera Cruz have already commenced inoculations for the prevention of yellow-fever. The material employed is injected hypodermically at intervals of eight days. Such a commission as could be selected from this country could establish the value of this method of prevention of yellow-fever, so strongly advocated by Freire and Carmona.

A TASK FOR ANATOMISTS.

"WALLACE," writes Oscar Schmidt, "might well say that we live in a world which is zoölogically very impoverished, and from which the hugest, wildest, and strangest forms have now disappeared." But old as the world appears, who shall say that it has passed or even reached maturity — if so be that worlds, like animals, have their day, as some have been bold enough to assert? It is true that the fishes no longer predominate, that the reptiles have dwindled into insignificance, and that of the mammals only a handful of great forms remain. But another type, the last to appear, and, of all, the most notable, — man, — is in the ascendant. His age is but begun. If we look upon the world of to-day as poorly furnished with striking animal forms, what must be the verdict of the man of the fiftieth or sixtieth century, when Europe will be a chain of cities, Africa and South America densely peopled continents, and North America the home of a population to be counted by hundreds of millions! The increase of powerful appliances for the subjection of the earth to human needs, within the memory of men now

living, is without parallel, and there is no indication that the climax has been reached. It is not, indeed, improbable that our age may come to be looked upon as plodding and unprogressive.

It is not, however, to the development of the world's resources to which I would direct attention, but to some of the effects impending from the ascendency of many, and the duty of zoölogists in connection therewith.

Some of the great changes in the zoölogical condition of the globe, incident upon the increase of human populations, the extension of railroads and the introduction of steam-power and horse-power, agricultural machinery, and the general use of perfected fire-arms, are familiar to everybody. The existence of vast herds of bison on the western plains of North America has become a matter of history. The aurochs, the bison's European cousin, is likewise menaced with destruction. "It no longer exists," says M. de Tribolet, "but in the condition, as one may say, of a living zoölogical specimen." Similarly the bands of destruction are daily tightening about the wapiti, the moose deer, the antelope, the manatee, and the mountain sheep and mountain goat, in North America; the chamois, the wild goat, the beaver, and the stag, in Europe; the kangaroo, in Australia; the elephant, the gorilla, and the chimpanzee, in Africa; and a score of other mammals, as well as birds and reptiles, in different parts of the world.

The reckless slaughter of some of these animals is painful to contemplate. "Some years ago," writes the author from whom we have just quoted, "a little family of beavers was discovered on an island in the Rhone; it was a happy accident, there was hope that we should see the revival of a species well-nigh extinct. All have been slaughtered without pity, — a folly which one could not have supposed possible, except among a non-civilized people, where the culprit is unconscious of his guilt." Words cannot entirely express the sorrow with which the true lover of nature witnesses the wanton annihilation of so many of the greatest and most interesting of living creatures.

But there is room for more than sorrow. There is good cause to fear, that, unless anatomists bestir themselves, many large species of vertebrates now existing will become extinct before their structure is at all thoroughly known. Gosse's dictum, that "it is better to err on the side of minuteness than of vagueness," should be applied to this matter. It would be best to lay aside thesis and hypothesis, and to record facts, — as many and as much in detail as possible. From the stand-point of to-day, rudimentary, defective, and 'nascent' structures attract an inordinate amount of attention, because of the light they shed upon the theory of evolution. But ten or twenty centuries hence a new theory may dominate, a new stand-point be taken, and a new standard adopted. Then the anatomical details we ignore may perhaps be diligently inquired into. We do not find fault with the early historians because they recorded so many facts, but because they recorded so few, and these so imperfectly. It may be that the fool *collects* facts, while the wise man *selects* them; but the wise man — the supreme genius — is one man of a million, and the fools had best content themselves with piling up the store of truths against his coming.

But whether fools or wise, posterity will certainly charge us with slothfulness if we fail to record, so far as our opportunities and appliances and the condition of zoölogical knowledge permit, the last details of the structure of those species of animals we know to be about to become extinct.

A work similar in character to this is being carried on at the present time by the Smithsonian institution's bureau of ethnology, the Davenport academy, and other similar organizations. American ethnographers have awakened to the fact that the study of the aborigines is becoming every day more difficult, and with most commendable zeal have set to work to record all that can be learned regarding the history, languages, religions, and customs of our Indian tribes. Let anatomists in all parts of the world follow the example of these investigators. In the case of vanishing peoples and species of animals, what the ethnographer and anatomist of to-day fail to record, the future archeologist and paleontologist can never find out, or can only guess at. F. W. True.

THE HISTORICAL ASSOCIATION.

The American historical association held its third annual meeting at Washington on Tuesday, Wednesday, and Thursday, April 29–May 1. The venerable George Bancroft presided at all but two sessions, when the first vice-president, Mr. Justin Winsor, librarian of Harvard college, took his place. The sessions were held in the large hall of the Columbian university, and were well attended. Mr. Bancroft's address of welcome was very well received. It will be printed in the next number of the *Magazine of American history*. Gen. J. G. Wilson of New York followed with a paper on Columbus, advocating an international celebration of the discovery of America by the great explorer. At a subsequent meeting a committee was appointed to wait on the President, to ask him to call the attention of congress to the matter. It is understood that the President received the

deputation favorably, and will recommend co-operation with other powers in his next annual message. Prof. E. N. Horsford of Cambridge then read a paper on the landfall of John Cabot in 1497. The substance of it has already appeared in Mr. Horsford's letter to Judge Daly, printed in the journal of the American geographical society, and also in the form of a monograph. Dr. A. B. Hart of Harvard came next, with 'A description of some graphic methods of illustrating history,' with examples of some maps and charts actually used by him in his lecture-room. The paper was listened to with great interest. But the only paper of the morning which evoked discussion was one by Prof. M. C. Tyler of Cornell, on the neglect and destruction of historical materials in this country. The reverend doctor was most justifiably severe on the almost criminal way in which American families, with a few notable exceptions, have treated the papers left by their ancestors. Judge Mellen Chamberlain of the Boston public library agreed with Dr. Tyler, and, in addition, called attention to the duty that certain families who have inherited public papers from their ancestors owe to the public to return all documents that really form part of the public archives to the public depositaries, whether state or national; and a motion to that effect was introduced and carried. It may seem singular that such a motion should be necessary, but one hundred years ago it was by no means uncommon for a governor or secretary of state, on his departure from office, to take away with him such public papers as interested him; and to-day many documents which form, or rather should form, a part of the archives, are in the hands of persons who know nothing of their value, and take no more care of them than they take of their own family papers.

In the evening Mr. Charles Deane of Cambridge presented, in behalf of Mr. Alexander Brown of Nelson county, Va., a paper embodying what may be called the modern views of the early history of his state. The Hon. William Wirt Henry of Richmond followed with a paper describing the part taken by Virginia in establishing religious liberty under the leadership of his grandfather, Patrick Henry. As might have been expected, Mr. Henry did full justice both to his ancestor and his native state. Dr. Channing of Cambridge followed with an abstract of a paper on the social condition of New England in the middle of the last century. He especially emphasized the fact that in one corner of New England slavery then existed on an extensive scale. Mr. T. Jefferson Coolidge, jun., who has been studying with him the past year at Harvard, then read a carefully prepared paper on the development of municipal government in Massachusetts. He showed that the first charter of Boston was a direct outgrowth of the New England town system. Judge Chamberlain, in the course of some remarks on this paper, pointed out how completely the individual masses of Americans had become accustomed to organizing.

The morning session of the second day was opened by Edward G. Mason, Esq., of Chicago, with a thoroughly enjoyable essay on the march of the Spaniards across Illinois. This was in many respects the most valuable paper presented. It will shortly be printed in the *Magazine of American history*, and needs no further mention here. At this session Mr. William A. Mowry of the *Journal of education* presented his well-known views upon the disputed question as to whether the Louisiana purchase included Oregon. Mr. Mowry's argument is in many respects a strong one; but it may pertinently be asked, supposing that he is correct in his assertion that Oregon was not within the limits of that purchase, how did the United States acquire it? Mr. E. B. Scott of Wilkesbarre, Penn., closed the session with an account of the settlement of the lower St. Lawrence.

In the evening Prof. A. Scott of Rutgers led off with a paper on the origin of the highest function of the American judiciary, in the course of which he remarked that he thought that New Jersey had some share in the revolution, which, judging from the general drift of the papers, seemed to have been the exclusive work of Massachusetts and Virginia. Mr. J. M. Merriam, an undergraduate student at Harvard, then read a paper showing that the number of removals usually attributed to Jefferson was much too small. This paper attracted considerable interest, and was printed in full in one of the Washington daily papers. Another of Dr. Channing's pupils, Mr. A. B. Houghton, was put down for a paper on the international aspect of the Panama canal. He was unavoidably absent, and a very short account of his work was presented. The last paper on the list for the evening was an address by Dr. F. W. Taussig of Harvard on the early protection movement and the tariff of 1828, in which it was shown that the Jackson and Adams men so angled for the votes of all sections that the tariff of 1828, as passed, pleased no one. Mr. Henry Adams, whose history of the period from 1783 to 1812 is so anxiously awaited by students of American history, closed the session with a few remarks supplementary to Mr. Merriam's paper. He thought, however, that credit was still due to Mr. Jefferson for not making even more removals than, according to the essayist, he did make.

But the third day was in many respects the most interesting day of all. Gen. G. W. Cullum,

at one time commander at West Point, opened the morning session with an interesting account of the attack on Washington in 1814. He was followed by two of the lecturers in the course recently given at the Lowell institute in Boston, under the auspices of the Military historical society of Massachusetts, — Col. William Allan of Maryland, formerly on 'Stonewall' Jackson's staff; and Major Jedidiah Hotchkiss of Staunton, who served through the war on Jackson's, Lee's, Ewell's, and Early's staffs. Colonel Allan gave an exposition of the confederate and federal strategy in the 'Pope campaign' before Washington in 1862. His remarks were illustrated by two large plans of the scene of those operations, and were listened to with the greatest interest, even by those to whom the subject was not familiar. Major Hotchkiss followed with an illustration of the value of topographical knowledge in battles and campaigns. He drew on the board with colored crayons a map of Virginia to illustrate his remarks. His dexterity was viewed with wonderment by those in the audience who have tried — though unsuccessfully — to accomplish the same results. In the evening the attendance was even larger than at any previous meeting. Mr. Bancroft presided, and was the recipient of an ovation which was as unexpected as it was genuine and merited. Mr. Justin Winsor was elected president for the coming year, with President Adams of Cornell and William F. Poole of Chicago as vice-presidents, while William Wirt Henry of Richmond took Mr. Weeden's place on the council. At this session Dr. J. F. Jameson of the Johns Hopkins read an abstract of a very valuable paper on Usselinx, founder of the Dutch and Swedish West India companies. The venerable president of the Massachusetts historical society, Dr. George E. Ellis, spoke of the necessity of an occasional reconstruction of history. He gave as an example the work now being edited by Mr. Winsor, — 'The narrative and critical history of America.'

Altogether the meeting was a most enjoyable one. The papers were for the most part creditable to the association, and especially to its secretary, to whom the making-up of the programme was in great measure left. The one regrettable feature was the continued absence of papers on other than American history. Why is it that the teachers of other periods do not come forward? Surely there must be good work done in other fields; and the hearty reception accorded Professor Emerton last year showed that the members are interested in what many regard as really more historical subjects than the comparatively recent history of America. The absence of papers on economic subjects, and on matters of present discussion, was marked. Excursions to Arlington, Mount Vernon, and points nearer headquarters, filled up the spare hours, and the experiment of holding meetings in some place other than Saratoga may be regarded as highly successful.

PROPOSED ENGLISH FISHERY BOARD.[1]

I HAVE read with considerable interest Professor Huxley's memorandum on the proposed fishery board, and with much of what he says I agree. It seems to me, however, that attention is likely to be diverted from the real question demanding consideration, by Professor Huxley's attack upon certain persons unknown, who appear to have demanded in some newspaper which Professor Huxley has seen, that men of science should 'manage the fisheries.' That men of science should interfere with commercial speculation, and manage the fisheries in that sense, is a proposition so preposterous, that it is difficult to understand why Professor Huxley should have thought it worthy of notice.

The question which really demands consideration is another one altogether, and is simply this: Is it desirable that men of science should be definitely and permanently employed to manage the inquiries which are necessary in order that a satisfactory basis may be obtained for legislation in regard to a variety of fishery questions? And, further, is it desirable that such persons should be employed by the state in order to ascertain whether certain steps in the way of protection and cultivation of fishes can be usefully carried out by the state for the benefit of the community? Professor Huxley does not, in my judgment, attach sufficient importance to such inquiries, and the necessity for a permanent organization of officials to deal with them, when he says, "Let the department obtain such scientific help as is needful from persons of recognized competency, who are not under the control of the administrative department." This proposal seems to be somewhat inconsistent with another statement in the memorandum, where Professor Huxley says, "I should say that any amount of money bestowed upon the scientific investigation of the effect of some modes of fishing might be well spent." If 'any amount of money' is to be spent, and so large a question as 'the effect of some modes of fishing' is to be investigated scientifically, then it would seem well that the department should have a trained and permanent staff of expert naturalists, and a scientific authority to direct their inquiries.

The fact is, that enough time and money have

[1] From the *Journal of the society of arts*, April 30.

been spent by the state upon spasmodic inquiries into the effects of trawling, and the various questions the rapid investigation of which has from time to time appeared to be 'needful.' What is now needed is a more systematic and determined attempt to grapple with some of the more important questions, the solution of which is likely to affect the interests of the fish industry.

I have drawn up a brief statement on the subject of the relation of scientific investigation to fishery interests, which, in no dogmatic spirit, but with a view to eliciting criticism and suggestion, I here submit to the reader: —

1. The necessity for an administration of our marine and fresh-water fisheries, based upon thorough or scientific knowledge of all that relates to them, has become obvious of late years. The trawling commission of 1884–85 has reported to this effect, in so far as the subject of their inquiries is concerned. Other nations have adopted such a method of dealing with their fisheries, with good results and the promise of better.

2. The inquiries and operations necessary cannot be conducted as the result of private commercial enterprise: they must be national in character.

3. While the general trade returns of the fishing-industry on the one hand, and the practical enforcing of regulations as to the protection of fishing-grounds and the restriction of fishing-operations within certain seasons and localities, are matters with which an ordinary staff of officials can effectually deal, yet the chief purposes of the operation of a satisfactory fisheries department are of such a nature that only expert naturalists can usefully advise upon them and carry them out. It is therefore important that the organization of a state fisheries department should either be primarily under the control of a scientific authority, who should direct the practical agencies as to trade returns and police, or that there should be distinct and parallel branches of the department, — the one concerned in scientific questions, the other in collecting trade returns and in directing the fisheries police.

4. It does not appear that there is any ground for supposing that individuals of scientific training are *ipso facto* unfitted for administrative duties, and there would be obvious advantages in placing the operations of a fisheries department under one head. Indeed, it may be maintained that a scientific education, and capacity for scientific work, are likely to produce a more practical and enterprising director of such a department than could elsewhere be found. It has not been found desirable to place the administration of the botanical institution at Kew in the hands of a non-scientific director, and there is no obvious reason for avoiding the employment of a scientific staff in the case of a fisheries department. It is extremely important, from the point of view of the public welfare, that the state should not set the example of ignoring the value of scientific knowledge and training; while it is no less important to avoid the waste of public money which must result from employing officials who are not conversant with the matters with which they have to deal, in place of trained experts.

The nature of the work to be done, is, 1°, generally to ascertain what restrictions or modifications in the proceedings of fishermen are desirable, so as to insure the largest and most satisfactory returns, prospectively as well as immediately, from the fishing-grounds of the English coast and from English rivers and lakes; 2°, especially to ascertain whether existing fishing-grounds can be improved by the artificial breeding of food-fishes and shell-fish, and to determine the methods of carrying on such breeding, and to put these methods into practice; 3°, to find new fishing-grounds; 4°, to introduce new fish, — either actually new to the locality, or new to the consumer; 5°, to introduce (if practicable) methods of rearing and fattening marine fish in stock-ponds; 6°, to look after the cultivation and supply of bait; 7°, to introduce new baits, new methods of fishing, improved nets, improved boats, new methods of transport and of curing.

The work can be divided into two sections: A. Investigation; B. Practical administration.

A. Investigation. — The inquiries which are necessary in order to effect the purposes indicated above are as follows: —

1. A thorough physical and biological exploration of the British coasts within a certain distance of the shore-line, especially and primarily in the neigborhood of fishing-grounds. The investigation must include a determination of temperature and currents at various depths, the nature of the bottom, the composition of the sea-water, and the influence of rivers and conformation of coast upon these features. At the same time, the entire range of the fauna and flora must be investigated in relation to small areas, so as to connect the varying living inhabitants of different areas with the varying physical conditions of those areas, and with the varying association of the living inhabitants *inter se*. Only in this way can the relation of food-fishes to the physical conditions of the sea and to their living associates be ascertained, and data furnished for ultimately determining the causes of the local distribution of different kinds of food-fishes, and of the periodic migrations of some kinds of them.

2. A thoroughly detailed and accurate knowledge of the food, habits, and movements of each of the important kinds of food-fishes (of which about five and twenty, together with six shell-fish important either as food or bait, may be reckoned). The relation of each of these kinds of fish to its fishing-ground must be separately ascertained; its time and mode of reproduction; the mode of fertilization of its eggs; the growth of the embryo; the food and habits of the fry; the enemies of the young and of the adult; the relation of both young and adult to temperature, to influx of fresh water, to sewage contamination, to disturbing agencies, such as trawling and ordinary traffic.

3. An inquiry as to whether, over a long period of years, there has been an increase or decrease in the abundance of each kind of food-fish on the chief fishing-grounds as a matter of fact, together with an inquiry as to the actual take of each kind of fish in successive years, and, further, an inquiry as to any accompanying variation in (*a*) the number of fishing-boats, (*b*) the methods of fishing, (*c*) the climatic conditions, or other such possibly influential conditions as previous inquiry may have suggested.

4. An inquiry for the purpose of ascertaining experimentally whether the decrease in the yield of fishing-grounds, in regard to several species of food-fish, can be remedied (*a*) by artificial breeding of the fish; (*b*) by protecting the young: (*c*) by increasing its natural food; (*d*) by destruction of its enemies; (*e*) by restrictive legislation as to time or place of fishing, and as to size of fish which may be taken, and character of fishing-apparatus which may be used.

5. An inquiry to ascertain whether, if periodic, natural causes are at work in determining the fluctuations of the yield of fishing-grounds, their effect can be foretold, and whether this effect can in any cases be counteracted; similarly to ascertain, in the case of migratory shoal-fish, whether any simple and trustworthy means can be brought into operation for the purpose of foretelling the places and times of their migrations, so as to enable both fishermen and fish-dealers to be ready for their arrival.

6. An inquiry into the diseases of fish, especially in relation to salmon and other fresh-water fish.

B. Practical administration. — The chief heads under which this presents itself as distinct from the antecedent search for reliable data are —

1. The management of an efficient 'intelligence department,' giving weekly statistics of the fishing-industry, the appearance and disappearance of certain fish at particular spots, the number of fishing-boats employed, the methods of fishing employed, the meteorological conditions.

2. The advising and enforcing of restrictions by the legislature as to time, place, and method of capture of fish.

3. The artificial breeding and rearing of fish to stock-impoverished fishing-grounds.

4. The leasing and management of the foreshore and sea-bottom in particular spots, for the purposes of oyster-culture and mussel-culture, and of marsh-lands near the sea for the formation of tanks and fish-ponds.

5. The opening-up of new fishing-grounds and of new fish-industries (curing and treatment of fish for commercial purposes).

6. The introduction of new species of food-fish and shell-fish.

It is a matter of fundamental importance to determine, first of all, whether it is desirable that these matters should be dealt with by a permanent staff, or, on the other hand, by the occasional employment of a scientific man — not habitually occupied in these inquiries — to attempt the solution of any particular problem which an unskilled official may present to him. Clearly there must be economy in employing permanently certain naturalists who will familiarize themselves with this special class of questions, and become experts in all that relates to fishery problems.

Further, is it desirable that the matters which are to be inquired into should be determined by an official unskilled in natural history? or, on the other hand, that the selection of inquiries likely to lead to a satisfactory result should be made by a man of science, specially conversant with the nature of the things to be dealt with?

The organization required consists, so far as persons are concerned, of, 1°, a chief scientific authority; 2°, a staff of working naturalist-inspectors; 3°, a staff of clerks; and, so far as material is concerned, of, 4°, a London office, with collection of fishes, apparatus used in fishing, maps, survey-records, statistical returns, and library; 5°, a surveying-ship, under the orders of the department, to be manned and maintained by the admiralty; 6°, a chief laboratory fitted for carrying on investigations such as those named above, and also two smaller movable laboratories, together with steam-yacht fitted for dredging and sounding; 7°, hatching-stations and fish-ponds.

With regard to the foregoing headings, it is a matter for consideration whether the 'chief scientific authority' should be an individual, or a committee af five. The position assigned to this post should be equal to that of the director of the geological survey, or the director of the Royal gardens, Kew; or, if the 'authority' takes the

form of a committee, it should be placed on the same footing as the Meteorological council. The person or persons so appointed should be responsible for all the operations of the department, and of such scientific training and capacity as to be likely to devise the most useful lines of inquiry and administration.

The 'naturalist-inspectors' should be six in number, but operations might be commenced with a smaller staff. They should be thoroughly competent observers, and, under the direction of the chief scientific authority, they would be variously employed, either on the surveying-ship, at the chief laboratory, or in local laboratories, hatching-stations, or in the London office and museum.

The naturalists thus employed would become specialists in all matters relating to the life-history of fishes and their food: they would acquire a skill and knowledge far beyond that which it is possible to find among existing naturalists, who occasionally are requested to make hurried reports on such matters as salmon-disease, or the supposed injury of the herring-fisheries by trawlers.

One of the naturalist-inspectors should be a chemist and physicist, in order to report on the composition of the water and the nature of the bottom in the areas investigated.

'Clerks' would be required in the London office to tabulate statistics and carry on correspondence. These gentlemen need not necessarily have any scientific knowledge. It would probably be necessary to have a correspondent or agent of the department in every large fishing-centre. Probably the coast-guard officials might be taken into this service.

With regard to material equipment, it appears to be necessary that a scientific fisheries department should have at its London office a museum of fishing-apparatus for reference and instruction, and also complete collections illustrative of the fishes, their food, enemies, and other surroundings. In the same building would be exhibited maps showing the distribution and migrations of food-fishes, the coast temperature and its variations, the varying character of the sea-bottom, sea-water, etc.

The surveying ship or ships would be provided by the admiralty.

A central laboratory is in course of erection upon Plymouth Sound by the Marine biological association. Her Majesty's government has promised to contribute £5,000, and £500 a year, to this institution, on condition that its resources are available for the purpose here indicated. Certain of the 'naturalist-inspectors' (probably three at any one time) would be stationed at the Plymouth laboratory in order to carry on special studies of the development and food of particular species of fish.

The smaller movable laboratories, steam-yacht, and other appliances would not be costly.

RAY LANKESTER.

NOTES AND NEWS.

WE learn from a letter of Professor Holden's, in the last number (2724–25) of the *Astronomische nachrichten*, just received, that the Lick trustees have decided to purchase from Messrs. Feil & Mantois a 36-inch crown disk, which was made by them at the same time with the crown disk of the objective now in the hands of the Clarks. The Clarks "have received the order to figure this disk as a third (photographic) lens for the large objective."

— The work of the U. S. fish commission shows most gratifying results in the artificial propagation of shad. An unprecedented abundance of these fish is noticed this season in all the rivers which have been supplied with young fish by the commission. This increase is noticed especially in the waters of the Pacific coast, where shad were unknown previous to their introduction by the U. S. fish commission.

— The New York assembly has passed the bill providing for the appropriation of twenty thousand dollars annually to the Metropolitan museum of art and the American museum of natural history, in order that they may be kept open to the public, free of charge, on Sundays. It is expected that it will soon be favorably reported by the senate committee, and become a law.

— The house committee on agriculture has reported favorably the bill to establish agricultural experimental stations in connection with the colleges established in the several states; also the bill to enlarge the powers and duties of the department of agriculture, making it an executive department.

— The U. S. coast survey has issued the following charts, which are now ready for the public: Topographical sheets of the re-survey of the harbors of New York, Brooklyn, and Jersey City. It is intended to combine these sheets with the hydrographic work already executed, and thus to give an extended and accurate map of all the waters lying around New York City.

— An international maritime exhibition will be held in Havre, May 1 of next year, to be devoted to all kinds of sailing or steam ships, engines, life-saving contrivances, fisheries, and the products of the French colonies. Applications to

exhibit may be made to the Direction de l'exposition maritime internationale, 118 Rue de Paris, Havre.

— A Japanese invention for making paper of seaweed, says *Engineering*, is announced. It is thick in texture, yet sufficiently transparent to be used as a substitute for glass in windows.

— The total output of coal in France for 1885 was 19,534,341 tons.

— The total annual production of naphtha in Russia during the past year reached 1,800,000 tons, — a very great increase over that of preceding years; and already a foreign market, especially England, is sought for its consumption.

— On March 17 the Smith college branch of the Audubon society was organized. The society now numbers ninety members, and is thoroughly interested in the theoretical and practical work connected with ornithology. Meetings are to be held once a month, when the members will read papers embodying the results of original research, or will listen to lectures from well-known ornithologists. Field-work has been begun under the guidance of Mr. John Burroughs, who took parties of observers out into the woods and meadows to study the birds in their homes, and to learn their notes. For regular field-work, the society is divided into groups of ten, under the direction of some experienced member, who teaches them the art of intelligent and accurate observation. Each party goes out for observation at a stated hour in the day, twice a week.

— Statistics of Saxony, with its three million inhabitants, show a very large number of professional and industrial schools and students. There are 235, with 17,000 students in attendance. They are devoted to a great variety of branches of special and technical education. Three, with 270 students, are for instruction in the manufacture of toys; a like number, with 60 students, are devoted to spinning; 35 teach the art of ribbon-manufacture to 1,500 apprentices; and at Dresden there are 100 pupils at the German academy of weaving. There are 25 commercial schools, with 2,800 in attendance upon them. Of the industrial schools proper, there are three, — at Mitweida, Leipsic, and Chemnitz, — having nearly 1,000 students altogether.

— Dr. Werner Siemens has placed at the disposal of the German government the sum of $115,000, to establish an institute for carrying on experiments in natural science. It is proposed to erect a building in which studies in exact science may be prosecuted.

— The following field assignments of coast-survey assistants have been made: Assistant Dennis is now engaged on the re-survey of Long Island; Assistant Jardella has the district from Ward's Island east to Throg's Neck; Assistant Hosmer will take up the re-survey of the north shore of Long Island Sound on the 1st of June.

— An effort is being made in Washington to obtain some suitable position for Lieutenant Greely, who is unable to perform active army service on account of his health. To this end Senator Harrison of Indiana is urging the passage of a bill for the appointment of an assistant adjutant-general, which office is intended for Lieutenant Greely. It seems most fitting that this gallant officer should receive some recognition from his government for his heroic services.

— The fish-commission steamer Albatross arrived at Washington on Tuesday last.

— *Science observer* circular No. 66 contains the announcement of the discovery by Dr. Luther, apparently on May 4, of an eleventh magnitude asteroid. This becomes number 258.

— The new science hall at Smith college, which was begun last summer, is rapidly approaching completion, and will be formally opened and dedicated on Tuesday of commencement week (June 20). The principal address on this occasion will be given by Prof. J. P. Lesley of Philadelphia. The building is the gift of a friend of the college, whose name will be announced at the opening. It is of brick, with brown stone trimmings, three stories in height and about ninety feet long and fifty wide, with an ell thirty feet wide and some twenty-three feet in length. The well-lighted basement and the ground-floor are to be occupied by the departments of chemistry and physics, while the first and second floors are for the work in biology and geology and the collections belonging to these departments.

— The spring meeting of the Indiana academy of sciences will be held at Brookville, Ind., May 20 and 21. This will be the first meeting of the academy since its organization, and an invitation is extended to all those interested, to attend it.

— M. Bender, in the *Moniteur scientifique*, describes a new system of lighting. He employs the fatty residues obtained from the rectification of crude mineral oils, through which he passes a current of air. The air takes up a definite quantity of this hydrocarbon, and the flame produced is very brilliant, giving off no smoke.

— The outbreak of cholera in Europe at Brindisi, from which much was feared, appears from late news to be rapidly diminishing. There have been but few deaths; and intelligence from other parts

of Italy indicates, that, with the exception of the northern part of the Adriatic, the peninsula is quite free from the disease.

— Fish-commission car No. 1 left Havre de Grace, Md., on Sunday last, with 1,500,000 young shad for Broad and Saluda Rivers, South Carolina. On its return it will take the same number of shad fry to Portland, Ore., for stocking the Columbia River basin.

— The Hibbert lectures for 1886 are now being delivered in London on Mondays, Wednesdays, and Fridays, and are repeated at Oxford on Thursdays and Saturdays. The lecturer this year is Professor Rhys of Oxford, and his subject is 'The origin and growth of religion as illustrated by Celtic Heathendom.'

— Mr. D. P. Wainright of the coast survey has completed the trigonometrical work in the vicinity of Cape Fear River, North Carolina. The field-parties from the south will begin to arrive in Washington about the middle of June. Parties will be sent east and north for field-work about the first of June.

— The ethnological collections of the British museum are now said to be for the first time adequately displayed. New rooms, formerly occupied for zoölogy, have been devoted to them, and recently thrown open to the public. The collection is now thought to be the best and most representative in the world.

— Messrs. James Pott & Co. have brought out an edition of Pressensé's 'Study of origins,' which first appeared in its English version in December, 1882. The author is a learned and accomplished Protestant minister of Paris. His position is that of a Kantian who firmly believes in God, the soul, and the future life; but he is liberal and broad, vindicating the complete independence of science, and saying unequivocally that neither the Bible nor the councils have any prescriptive right to control science. He is convinced that experimental science is not hostile to the principles of theism; and that, if 'the possibility' of a divine and moral world be conceded, there are processes of experiment which will supply the demonstration. From this basis the author discusses the problems of knowledge, being, and duty in the light of modern German, French, and English philosophical writings.

— The publishing-house of Justus Perthes has recently begun a new edition of Berghaus's 'Physikalischer atlas,' which will contain seventy-five maps. The first *lieferung* contains a map showing the distribution of the flora of Europe; another, the isotherms of the world; and a third, the soundings in the Mediterranean and Black seas, and also the character of various portions of the shore, which is undergoing rapid changes.

LETTERS TO THE EDITOR.

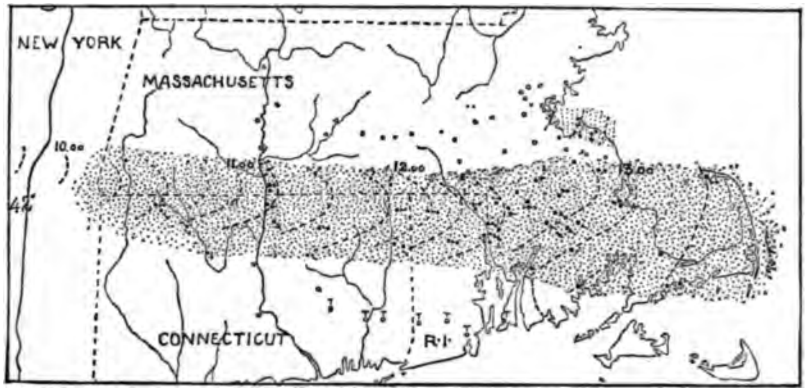
**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A thunder-squall in New England.

THE study of thunder-storms that was undertaken as a special investigation by the New England meteorological society in the summer of 1885 was successful in gathering records from a good number of volunteer observers, on which a tolerably complete statistical account of the storms may be based: thus there appears a distinctly earlier afternoon maximum of storm-frequency in western than in eastern Massachusetts, implying that distance from some at present unknown district of origin, as well as high temperature, exerts a control on the time of the storm's arrival east of the Hudson. In several of the better-developed storms the data accumulated were sufficient to define the more prominent physical features of the storm with considerable accuracy: this was especially the case with the small but violent thunder-squall that crossed New England about noon on July 21, 1885. The storm belongs to a class first clearly defined by Dr. Hinrichs, director of the Iowa weather-service, several years ago, and differs distinctly from the tornado in having a blast of outrushing air in front of its rain. The example here described came to us from western New York, where certain observations furnished by Prof. H. A. Hazen of the signal service reported it about six or seven o'clock in the morning: two of our observers in central and eastern New York recorded it at later hours; and at a little after ten o'clock it entered New England near the notorious Boston Corners, the former south-western angle of Massachusetts; thence it followed an almost due-east path, gradually broadening its rain-area, as it advanced, until it ran out to sea a little after noon, its average hourly velocity being forty-eight miles. All observers agree in giving it a rapid approach, a short, violent passage, and a quick disappearance. Very soon after its clouds were seen and thunder heard, the brief wind-squall came rushing in advance of the pouring rain; and an hour or so later the whole storm was out of sight in the east. With the wind came a rapid fall of temperature and a distinct increase of pressure. The thermograph, barograph, and anemograph curves, furnished from the city engineer's office in Providence, are here particularly interesting, as they record fluctuations produced by the nearly central passage of the storm. The temperature fell 13° in half an hour as the storm came overhead, and soon rose again to a high afternoon maximum as the clouds cleared away. The barometer quickly rose four-hundredths of an inch at the arrival of the storm, and the wind increased from a gentle breeze to a rate of about forty miles an hour.

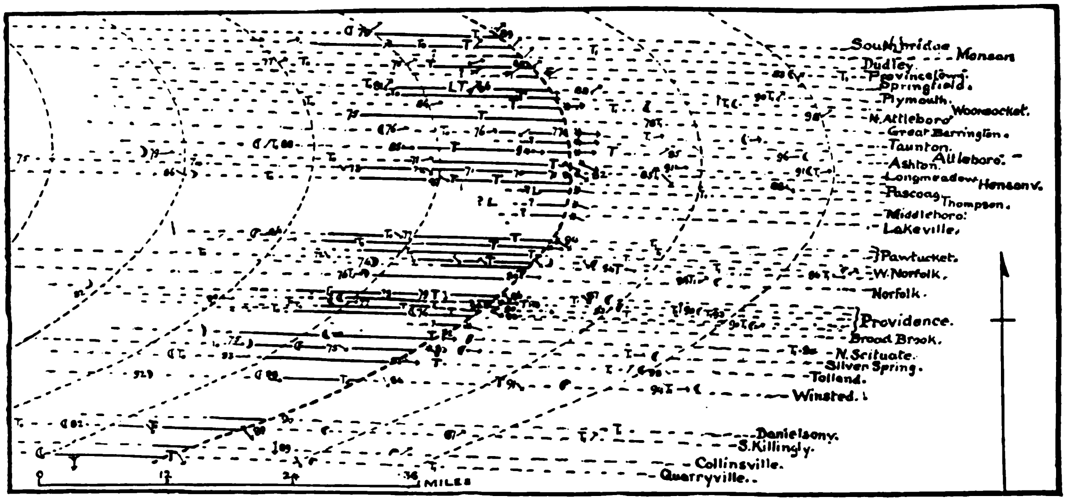
The persistent individuality of this storm, maintaining a constant association of its several features over the greater part of its observed path, justifies the construction of a 'composite portrait,' by means of which all the observations are thrown into their proper position with respect to two governing lines, — the rain-front and the storm-axis. In this figure, the curved lines, convex to the east, measure fifteen

minutes in time, or twelve miles in distance, ahead of or behind the rain-front; and the straight lines, parallel to the storm-axis, mark the paths of the several stations through the storm, as if they moved westward while the storm stood still. Appropriate figures and signs for temperature, wind, sky, etc., placed on the line of their station and at their proper time-interval before or after the beginning of the rain, then represent all the records that were gathered, and bring them together on a single diagram. Thus we see the gradual fall from high temperatures, as the clouds (shown by black crescents) became visible, and the thunder became audible; the sudden increase of the wind velocity, and its radial direction at the front of the rain-area; the longer duration of the rain, and the greater fall of temperature, at the centre than at the margin of the storm; the gradual warming-up again as the rain ceased and clear sky (white crescents) appeared.



The 'portrait' would doubtless have been truer if our stations had been more plentiful in north-eastern Connecticut and south-eastern Massachusets; but, in a first season's work, it was impossible to secure a sufficient number and an equable distribution of observers. Especial attention will be given to these requisites during the coming season, when the investigation will be continued with improved opportunities, and all careful observers will be encouraged to co-operate in the work. W. M. DAVIS.

Cambridge, Mass.



COMPOSITE OF THUNDER-SQUALL, JULY 21, 1885.

(All observations thrown in their proper place with respect to rain-front and middle path.)

Interval between curves, 15 minutes.
Numbers give temperature (F.).
T_1, T, T_0, first, loudest, last thunder.
☾, clouds in west.
☾, clear in west.
L, lightning-stroke.
——>, light wind.
→→——>, heavy wind.
——, duration of rain.

The Davenport tablets.

In the November number of the *American antiquarian* there appeared an editorial wherein it was charged that Rev. J. Gass, a member of the Davenport academy, by exchange had imposed upon Mr. A. F. Berlin certain alleged fraudulent mound-relics, and it was there plainly intimated that these disclosures tended to place all that gentleman's dis-

coveries under the ban of suspicion. In the January number, 1886, of the same magazine, there also appeared an elaborate attack by its editor upon the authenticity of the Davenport tablets, of which the Rev. J. Gass was a principal discoverer. In the March number there further appeared a communication from Mr. A. F. Berlin, containing the statements that Rev. Mr. Gass had made some exchanges, not with himself, but with Mr. H. C. Stevens of Oregon, and that most of the mound-relics sent by Mr. Gass to Mr. Stevens were 'modern' or fraudulent. These statements were submitted by the writer to Mr. Gass, and his explanations as furnished to me will be found in the following communication. This letter from Mr. Gass was written in German; and the translation herewith furnished for publication was made by Prof. William Riepe, who was formerly connected with the public schools of this city, and subsequently revised by Carl L. Suksdorf, Esq., principal of the German free school. It is proper to state that Mr. Gass preaches and teaches in German, and as his few English letters, on account of his imperfect knowledge of the language, are usually dictated to an impromptu amanuensis, they but imperfectly represent his precise meaning.

The publications in the *Antiquarian* were made without communication with the Davenport academy, and without affording Mr. Gass an opportunity for explanation. In correspondence with Mr. Berlin, the writer represented that Mr. Gass should have an opportunity to inspect the relics in question, and requested that they should be forwarded to the Davenport academy for this purpose. This request was declined. The statement of Mr. Gass should have appeared in the *Antiquarian;* but as we are denied admission to its columns, except under restrictions neither the Davenport academy nor Mr. Gass could accept, we shall have to ask of you the favor of its early publication.

In conclusion, permit me to say, that, while the members of the Davenport academy have the most unbounded confidence in the integrity and good faith of Rev. Mr. Gass, it should be stated that the question of the authenticity of its inscribed tablets does not by any means wholly depend upon his reliability. As may be seen from our published statements, there were other persons present at the discovery of these relics, and certificates as to the facts made by these well-known and highly esteemed citizens are preserved among the archives of the academy. These additional evidences have never yet been given to the public, and, when published, will furnish strong corroborative proof of the genuineness of the relics in question.

It is always to be deplored when personal considerations enter into scientific discussions, but in archeological research, where the question of the authenticity of relics so largely depends upon the integrity of the explorer, character becomes an important factor, and is a legitimate subject for inquiry. In cases like that under consideration, however, this moral test should be sternly applied alike to the accuser and the accused. CHARLES E. PUTNAM,

President Davenport academy of sciences.

Davenport, Io., May 6.

[Communication from Rev. J. Gass.]

CHARLES E. PUTNAM, Esq.

Dear Sir, — In accordance with your request, I will hasten to give you an account, so far as it is still now possible for me to do, of my transactions with Mr. H. C. Stevens of Oregon City, Ore., in regard to the relics in question.

I formerly often received letters and circulars offering me relics, or wishing to exchange or buy from me. Among others I received also in April, 1881, a postal-card from Mr. Stevens. This I handed to our curator of the academy, Mr. W. H. Pratt, as I had not the least intention to make any exchange with him myself. To our curator, however, the offer was quite welcome, and he authorized me to write to Mr. Stevens that he was willing to make such exchanges. Mr. Stevens immediately sent a number of relics which pleased us all very well. At this time, I do not know positively whether before or after I had seen those articles, awoke in me the very unhappy wish, as it now appears, to possess a few good small arrow-heads to be used as charms for my little daughter. I therefore collected what was in the house, the best of which was a small box of flint implements which I had received from Rev. C. Mutschmann of Missouri. All these were of a primitive character, and therefore not of especial value for our museum. Among the objects received from Pastor Mutschmann there were a small stone axe, an Indian stone pipe, and also fragments of such a one. The pipe had about the following form:

It was of grayish color, rough, without polish. The broken one was of a similar character. Pastor Mutschmann wrote to me at that time that he was told that the pipe was found in an Indian grave on the Missouri River, I believe in St. Charles or Warren county. I took the pipes and other relics without any doubt as to their genuineness, and did not test them in any way. I supposed the material to be gray pipe-stone.

I packed all, as I had received them, in two paper boxes, and sent them by mail to Mr. Stevens. Thereupon I received from him a number of small arrow-heads, of which a few were nice and whole, but the most were broken. At the same time I received a letter from Mr. Stevens, in which he remarked that the articles sent were not worth the postage I had paid, for it was all broken, worthless stuff. In my answer I endeavored to defend the relics as not being entirely worthless; and, somewhat hurt and irritated by what I considered the unjust remarks of Mr. Stevens, I have, as I now see, somewhat overestimated the value of those articles. He remarked at the same time that the pipes were not old (ancient) Indian pipes, but were modern, made by white people; at least, some one had told him so. I gave no credit to this statement, but took it for an empty excuse made in order to give me little or nothing for them. If I had entertained the *least* doubt of their genuineness, I would not, under any circumstances, have sent them; or at least, after Mr. Stevens had made these remarks, I should certainly at once have asked them, and taken them back at any price.

As to who has written my letters for me, I cannot now say positively. Mrs. Gass says it was certainly done by one of my pupils, and I believe she is right. A letter in German, written by myself, would surely have sounded quite differently. These unfortunate letters have, however, been sent in my name, and with my name, and I must now abide the consequences, come what will. I can scarcely under-

stand, even now (supposing that Mr. Berlin's copy of my letter is correct), how the incorrect statement that the academy had bought such pipes, and paid such high prices for them, could have occurred unobserved. The boy who wrote the letter for me must have misunderstood me, and from my ignorance of the English language I overlooked this error. It may be, that, not attaching much importance to this letter, I may have sent it without first examining or looking it over.

In regard to the relics in question, it is impossible at present for me to determine whether those which Mr. Stevens *claims* to have received from me are actually *the* objects which I have sent him; for I have not seen them as yet, and for the present shall have no opportunity, as Mr. Berlin has informed you that he could not send them for my inspection without the consent of Mr. Stevens. On the contrary, Mr. Stevens says that they no longer belong to him, but to Mr. Berlin.

Immediately on receiving your first communication on this matter, I resolved to send back to him the arrow-heads received in exchange, and to request him also to return those which he claimed were *not genuine* to me. Mr. Stevens returned the package to me, and refused to give me back those which he claimed I had sent to him, with the excuse that they were no longer in his possession, as he had given them to Mr. Berlin. Hence obviously it is impossible for me to determine as to the correctness of the statements made by those gentlemen concerning said relics. Their refusal to allow me to inspect the objects is very strange and perplexing to me.

As Mr. Stevens informs us that many of the relics I sent him were thrown out in the yard on a pile of other rejected relics, and have been lying there some years exposed to the weather, it is no wonder they became, as he says, considerably changed in appearance, and the labels lost. Under these circumstances, and after so long a time, it must have been very difficult for him to select the relics in question, and to distinguish them with certainty from those received from other sources in his extensive exchanges. I have no doubt, if I could see the relics, I should recognize many or most of them, unless they have been so changed by Mr. Stevens as to be no longer recognizable. Until this opportunity is afforded, the present account of the transaction must suffice.

That the intention or the thought of having any thing to do with doubtful relics, or of deceiving any one with them, was far from my mind, will, to you, scarcely require any special assurance from me.

J. GASS.

Postville, Io., April 10.

The above is a correct translation from the German of a communication written by Rev. J. Gass to Charles E. Putnam, Esq., bearing date April 10, 1886.

CARL L. SUKSDORF.
WM. KIEPE.

Davenport, Io., May 4.

What was the rose of Sharon?

An interesting question is renewed, in a late number of the *Edinburgh review*, on 'What was the rose of Sharon?' It is very possible that some of the readers of *Science* may be able to throw further light upon the subject, or at least give trustworthy opinions as to the merits of 'crocus,' 'narcissus,' or 'reed.' The extract is, I hope, of sufficient interest to merit republication: it is as follows:—

"The 'rose of Sharon' has long been a disputed point. The Hebrew word *khabatseleth* occurs only in Canticles ii. 1, and Isa. xxxv. 1. The Revised version reads 'rose' in the text, and 'autumn crocus' in the margin. We are of opinion that the narcissus (N. tazetta) is intended. The scene of the Canticles is in the spring, when the narcissus would be in blossom: it is very sweet, has long been and still is a plant of which the orientals are passionately fond. Hasselquist noticed it on the plain of Sharon; Tristram, in cultivated land and lower hills from Gaza to Lebanon; Mr. H. Chichester Hart, in the districts between Yebdna and Jaffa (plain of Sharon). 'Some low-lying patches,' he says, 'were quite white with it.' The October quarterly statement (Palestine exploration fund) contains a valuable paper by Mr. C. Hart, entitled 'A naturalist's journey to Sinai, Petra, and South Palestine, made in the autumn of 1883.' The autumn crocus has no perfume, and would not be in bloom till late in the year. The narcissus is a bulbous plant, which is apparently implied in part of its Hebrew name; i.e., *betsel* (a 'bulb,' an 'onion'). But quite a different plant has very recently appeared as the claimant to the honor of being the 'rose of Sharon:' an Assyrian plant name is introduced to us by Dr. F. Delitzsch. Among the names of different kinds of *kînû* ('reed') and of objects made of it, occurring on a tablet in the British museum, and published in 'The cuneiform inscriptions of western Asia,' mention is made of one called *khabatsillatu*, which in sound is identical with the Hebrew name in Canticles and Isaiah; so that Dr. F. Delitzsch, without a moment's hesitation, upsets all other floral aspirants with one decided blow, and reads 'reed of Sharon,' 'the desert shall rejoice and sprout like the reed.'"

C. W. T.

Thermometer exposure and the contour of the earth's surface.

Various writers during the last hundred years, and perhaps earlier, have called attention to the marked differences of temperature which are frequently to be found in clear weather between hill-tops and adjacent valleys. Recently Hann and Woeikof in Europe have written numerous papers on the subject; and in this country instances have been given by J. W. Chickering, jun., and S. Alexander (*American meteorological journal*), Professor Mendenhall (*Science*), Professor Hazen (Professional paper of the signal service, xviii.), and Prof. W. M. Davis (*Appalachia*). But attention has not generally been attracted to the bearing these differences of temperature have on the subject of thermometer exposure.

My attention was drawn to the subject by the marked differences of temperature which were reported by different observers at Ann Arbor, Mich., during the cold period of the winter of 1885; and, in order to study the subject, a regular series of observations were begun between the astronomical observatory at Ann Arbor and an adjacent valley through which ran the Huron River. The bottom of the valley was about a hundred and fifty feet lower than the land on each side of it, and was about a quarter of a mile distant from the side on which stood the observatory. The method employed was to obtain the temperature at the observatory by means of a sling thermometer; then descending the

hill, and whirling the thermometer, to read it at intervals until the bottom was reached. A return trip was then begun, and the temperature obtained again at the top of the hill. Later, minimum thermometers were similarly exposed at both places, and their readings compared. Early on clear mornings, and at night, the temperature was usually found several degrees lower in the valley, and differences of ten degrees were not uncommon. At 7 A.M. on the morning of Feb. 18, the temperature at the observatory was 3¼° below zero. On descending the hill, the thermometer fell rapidly, and at the bottom of the valley read 18° below zero. The fall was greatest along the steepest decline, and in one place fell three degrees within twenty-five feet. Returning, the thermometer rose rapidly, and at the top of the hill again read 3¼° below zero.

During the continuance of these observations, Professors Pettee and Schaeberle kindly consented to take simultaneous observations of temperature with those at the observatory. One lived about a mile to the south-west, and the other about the same distance to the west. Professor Pettee was at about the same level as the observatory, and his readings differed but little from the observatory readings; but the observations taken at the home of Professor Schaeberle, which was at a considerably lower level, several times gave temperatures ten degrees lower than those at the observatory. These lower temperatures, observed both in the adjacent valley and at the home of Professor Schaeberle, were only found at night and on clear, quiet mornings, and disappeared in the middle of the day and in cloudy weather. They were due, no doubt, to the fact that the air most cooled by radiation, or by contact with the earth's surface thus cooled, was heaviest, and sunk to the lowest levels. In the middle of the day the temperature was usually found slightly higher in the valley than at the observatory.

It seems evident, then, that for scientific purposes which are intended for the study of temperature changes over large sections of country, and where stations can only be obtained many miles apart, it is necessary to avoid these merely local differences of temperature; and the only method of eliminating them is to get above them: in other words, wherever irregularities in the earth's surface exist, the thermometer should be on, or at least as high as, that of any considerable portion of land surrounding it, and not in valleys. The thermometer should, if possible, be away from buildings, and as many feet above ground as convenient. The best form of shelter is probably that devised and described by Professor Hazen. I have found by comparison that thermometers placed in accordance with these considerations differ but little in their readings, though they are many miles apart in a horizontal direction. But scientific people should not fall into the error of supposing that thermometers so placed represent the temperature over the adjacent country. The position is merely that in which local influences are attempted to be avoided; and it is not safe to say to persons that their observations must be erroneous because they differ from those of the signal service or some observatory.

This is a subject I think well worthy of the consideration of those in charge of state weather services. H. HELM CLAYTON.

Blue Hill observatory.
Readville, Mass., April 16.

Double vision.

Since my earliest boyhood, or for more than fifty years, I have had double vision and stereoscopic eyes, which I have probably exercised more than a million times. I have exercised the double vision to such an extent that it has become to a certain degree compulsory, as, if I look at an object forty feet more or less distant, all intervening objects are doubled involuntarily.

I often stereoscope (if that be a good verb) wall-papers and carpets, if figures be of proper size, arrangement, and distance. This has a wonderful effect, producing the following changes: the walls of an ordinary room are apparently thrown to a distance of a hundred feet, and are proportionately increased in size. Any defects in the putting-on of the paper will exhibit themselves in the same manner as I shall mention when describing the effects on gratings or lattice-work. The borders of the paper, if not 'stereoscoped' at the same time, with all pictures, etc., on the walls, will remain at their proper distances, and seem suspended in the air, like Mohammed's coffin. The surface of the paper is also remarkably increased in brilliancy. In 'stereoscoping' common photographs, they are thrown to a much greater distance, and the proper stereoscopic effect is brought about in the middle one of the three. I suppose this accounts for the increased size of the walls of rooms when so treated.

What has bothered me the most is the effect on gratings and lattice-work. In a piece of lattice-work, say, eight by ten feet, and the eyes five feet distant, the work is broken up, and has, instead of a common surface, an apparent depth of three or four feet. In some places there will be but a single piece; in other places two or three will be together with their parallelism properly preserved. I suppose that it is brought about by irregularities in the construction of the diagonals in the structure; but I do not know enough about optics to explain this peculiar breaking-up, and differences in apparent distances of the different pieces making up the work. The same effects are produced in looking down at gratings in pavements. GEO. KELLER, M.D.

Bucyrus, O., May 10.

Partition of Patagonia.

The geographical note on the 'Partition of Patagonia' in the current issue of *Science* (No. 170) calls to mind your recent strictures on cartographers for failing to keep our school maps up to the times. It would be but fair to state that the cartographers are not delinquent in this instance. The treaty of partition was concluded at Buenos Ayres, July 23, 1881, — five years ago. For the last three years all our more popular school geographies have shown the boundaries of Chili and the Argentine Republic as determined by this treaty. RUSSELL HINMAN.

Cincinnati, May 10.

An old-time salt-storm.

Can any of your readers tell me the exact date of the so-called 'salt-storm' which came upon the coast of Massachusetts about 1815? As described by old inhabitants, there was a high wind and heavy rain, and the houses and all objects within a mile of the water were coated with salt. Are such storms of frequent occurrence, and what is their explanation? .H. C.

Salem, Mass., May 10.

// SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 14, 1886.

CROSS-FERTILIZATION OF PLANTS BY BIRDS.

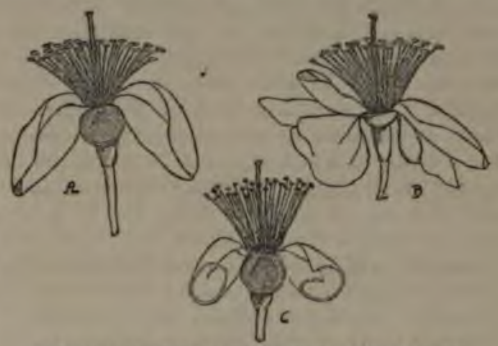
ADAPTATIONS for cross-fertilization exist in an almost endless variety throughout the vegetable kingdom, and have afforded a wide field for study and speculation to biologists. Many of great interest have been described by Hermann Müller as occurring in South American plants; and now the well-known South American naturalist, Fritz Müller, adds in *Kosmos* (1886, i. 93–98) a very remarkable discovery of adaptation to cross-fertilization by birds, — the first case of the kind, it is believed, that has been observed in the vegetable kingdom.

The flowers of the common European myrtle, with their delicate white corolla and crown of white stamens and simple pistil, are familiar to all. Very similar are the white flowers of the trees and shrubs belonging to the numerous species of the genera Campomanesia, Psidium, Myrcia, and Eugenia of the same family (Myrtaceae), occurring in great abundance in South America. Many of the species blossom in such profusion that the trees appear nearly white, and the pleasant odor that not a few give off attract bees and other insects in great numbers; and while in many others the flowers are not so conspicuous, and the perfumes not so evident, yet the pollen is easily transferred from flower to flower, and tree to tree, by the agency of insects.

In this uniformity among the genera and species a singular exception is found in the 'goiabo do campo,'— a not uncommon tree in the higher lands of Brazil, and widely known for its excellent fruit. The single species belong to the genus Feijoa; and its popular name, as well as its mode of growth and its foliage, recalls the wide-spread common guava-tree (Psidium pomiferum).

The flowers are found usually at the extremity of the twigs, or more rarely in the axils of the leaves, in groups of from two to five, on short stems. The leaves in whose axils the flower-stems, or the twigs bearing them, occur, are reduced to rudimentary bracts; and the flowers, for this reason, are more conspicuous than they would be were they enveloped by leaves, as is usual in the allied genera. A yet more especial adaptation to the means by which they are fertilized is the duration of flowering, which extends for months, during the entire spring, single blossoms appearing here and there over the tree.

The sepals form two pairs, — those of the one about six millimetres in length, and of equal breadth; of the other, twice as long and a little wider. In the unfolding of the blossom they are turned downwards, and present only the dark reddish-brown inner side. The petals at first are about fifteen millimetres long and as many broad, firm and leathery, and arched outwards; the inner side, of a purplish-red color. Within a day they grow to double the length and breadth, and so roll up longitudinally that they form a tube not more than one-third of the width, the leaves of the two pairs rolling or turning in opposite directions.



BLOSSOMS OF FEIJOA, FIVE EIGHTHS NATURAL SIZE.

Together with these changes in size and shape, there are others in color and taste. The external side of the petal, all that is now visible, becomes pure white, contrasting with the dark background of the sepals; and instead of being thickened and tasteless, or with a slight acrid taste, as is usual in so many of its congeners, like the clove and other species, it has now become soft and very sweet, and without any acridity.

The dark blood-red stamens, to the number of about fifty or sixty, are about eighteen millimetres in length, thickened and stiff, and expanding above into a crown more than an inch in diameter. The anthers lie horizontally, and liberate their bright yellow pollen nearly at the same time that the petals reach their complete development. The single pistil is likewise firm and stout, and extends above the plane of the anthers. As an unusual occurrence, there were found at one time

flowers in which one or more of the sepals had been transformed into petals, as shown in fig. B; and, from their evident relation to each other, the author notices the fact as deserving the attention of those who would speculate upon laws of variation and heredity.

From the description it will be seen that the flowers are conspicuous, having deep-yellow pollen, dark blood-red stamens and pistil, snow-white petals, and dark sepals, all unhidden by the foliage. But, notwithstanding this conspicuousness, the flowers are seldom visited by bees, there being, as was found, little or no nectar or honey to attract them. Even in cases where bees were observed upon the flowers, the prominent pistil did not readily admit of fertilization. The author was surprised, however, to find that soon after blossoming very many of the petals were severed near the middle, or at the base, by a single strong incision. By watching he soon discovered the cause to be birds of the genus Thamnophilus. These birds, of which the male is black and the female brown, alighted usually upon a branch above the one on which a flower was in bloom, and, reaching downward, bit off the petals; but, in so doing, either the neck or forehead invariably came in contact with the anthers, and brushed off the pollen, leaving the flower as seen in fig. C. Whether birds of this genus, especially in the more normal habitat of the tree in the higher lands of Brazil, are the only agency of cross-fertilization, or whether other birds share in it, remains to be discovered.

In Europe it is only exceptionally that birds are attracted by flowers. Sparrows sometimes bite off the flowers of the yellow crocus, and the bullfinch will pluck with inherited dexterity that portion of the under part of the primrose which contains honey. No adaptation has hitherto ever been observed where such mutilations of the blossom were of direct advantage to the plant, and the present example of Feijoa is therefore the more remarkable for the high degree of perfection which this adaptation has reached. Instead of the sweet petals being spread out for ornament alone, out of which the bird could pluck but a small portion, they become rolled up, thus permitting a larger part to be bitten off, and presenting greater attractions. The stout, firm anthers, and pistil, are likewise adaptive, insuring the clinging of the pollen to the feathers of the bird, and thus its ready transportation from one blossom to another.

How these adaptations have been brought about can scarcely be conjectured, as the genus is widely removed from the allied genera, and there are no intermediate forms.

PROFESSOR HUGHES ON SELF-INDUCTION.

THE recent researches of Prof. D. E. Hughes, president of the Society of telegraph engineers and electricians, have been extended by him, and his latest results will be published in a forthcoming number of the *Society's journal.* We are enabled to give some account of these researches from an account published in *Engineering.*

The extra resistance of a wire during the 'variable period,' that is to say, when the electric current entering it is rising to its normal strength, has been shown by Professor Hughes to proceed from an extra current of opposite name self-induced in the wire. He finds, however, that there are cases in which this effect is reversed, so as to produce less resistance in the wire during the variable period. Such cases occur when extremely fine wires are being tested with powerful currents; for the steady current heats the wire, thus introducing an extra resistance. The induction-bridge of Professor Hughes enables him to study and analyze these effects, tracing them to their true cause.

Professor Hughes has lately been investigating the self-induction of coils, as well as of straight wires, and the following table gives his result:—

Coils formed of 8 metres of silk-covered copper wire 1 millimetre in diameter, each coil being 8 millimetres in diameter.	Comparative force of the extra currents.
One coil alone	100
Two similar coils in series	174
Two similar coils in parallel, but separated 5 centimetres from each other	55
Same two coils in parallel, but superposed	81
One single coil of thicker wire of exactly the same form, length, and resistance as the two coils in parallel	75

This table shows an increase of the self-induction when the two coils are in series, but not quite double the effect, as there is an increased or added resistance. This result is well known; but a more interesting result is obtained where the two coils are parallel and separate, giving 32 per cent less self-induction than when they are superposed, and 26 per cent less than that of a single coil of the same resistance. Professor Hughes traces this result to the reaction of contiguous coils on each other.

With regard to the self-inductive capacity of non-magnetic wires of different metals, but of the same lengths and diameters, Professor Hughes finds that when non-inductive resistances, say, of carbon, are added to the wires to bring them to equal resistance, there is apparently no difference in the self-inductive capacity of all the metals he has yet tried; but if, instead of adding a supple-

mentary resistance of carbon, the wires are taken of the same length and resistance, their diameters being different, he finds a marked difference in their inductive capacities. For instance: a pure copper wire, compared with a brass one of double the diameter, shows a much higher self-induction; and Professor Hughes remarks in this connection, that, as the diameter increases, the reactions of the current in the contiguous parts of the wire on each other become less. The following table gives some fresh values of the electromotive force of self-induction currents in wires and strips one metre long, that of a chemically pure copper wire one millimetre in diameter being taken as 100:—

Wires of the same diameter, but of different resistance, 1 metre in length.

Soft Swedish iron	500
Copper	100
Brass	65
Lead	50

Wires of the same resistance, but of different diameter, 1 metre in length.

Soft Swedish iron	400
Copper	100
Brass	88
Lead	81

Strips of the same width and thickness, but of different resistance, 1 metre in length, 12 millimetres wide, 1-10 of a millimetre thick.

Copper	60
Brass	48
Iron	45
Lead	85

Strips of the same resistance and thickness, but of different widths, 1 metre in length, 1-10 millimetre thick.

12 millimetres wide (copper)	60
42 " " (brass)	45
72 " " (iron)	39
96 " " (lead)	29

In the above table, wires of the same diameter follow in the order of their resistance, iron alone being the exception. The same order is preserved in wires of the same resistance, but of different diameters. In the latter case there is a nearer approach to equality, but they still show a difference of from 12 to 19 per cent; and, while the non-magnetic metals have increased their inductive capacity with increased diameter, iron has fallen 20 per cent: consequently wires of different metals of the same resistance have not the same inductive capacity, owing, probably, to the action of contiguous portions of the current, as Professor Hughes has already shown.

If we reduce the extra currents by employing thin sheets or strips, there is, in the case of iron, a still more remarkable difference, for in strips of different metals of the same width the force of the extra currents in iron is actually less than that in brass; and if we compare an iron strip with an iron or copper wire of the same resistance, we have, iron 500, copper wire 100, and an iron strip 45, or 55 per cent less than the copper wire.

In the case of wires a nearer approach to equality in inductive capacity is shown when they are of the same resistance, but in strips this is reversed; for here, when equality in resistance is produced by wider strips, the difference becomes greater, iron then having actually less inductive capacity than a lead wire of the same resistance. Professor Hughes attributes this remarkable result not only to the reactions of contiguous portions of the current being less in sheets or strips than in wires, but also to an imperfect formation of the circular magnetism which takes place in iron wires on the passage of an electric current. He has tried all forms of conductors, such as those of square, stellar, and tubular section; and all of them show a diminution of inductive capacity as compared with wires of solid circular cross-section. In solid conductors the maximum self-induction appears in those of circular section, and the minimum in wires formed into a flat strip.

While re-affirming his statement that the best lightning-rod is a flat strip of copper, or a galvanized iron strand wire, Professor Hughes has made experiments with American compound wires consisting of a steel core coated with copper, or a copper core coated with steel. He finds that the copper coating has an enormous influence in reducing self-induction in the steel. Without it the self-induction was found to be 350 as compared with a copper wire giving 100, whereas with it the self-induction was only 107, or 7 per cent more than copper alone. This effect is explained by the fact that the circular magnetism created by the passage of a current through an iron wire is produced chiefly on the exterior portion of the wire; and if this is of copper, it is practically suppressed. On the other hand, copper wire coated with steel has a greatly increased self-induction as compared with copper wire uncoated. It even has a higher self-induction than a solid iron wire, and its resistance in the variable period is proportionally greater than that of a soft iron wire. Professor Hughes has made numerous experiments on this point; and they all show, that, while copper in a straight wire or a single *wide* loop has a far lower inductive capacity than iron, it has, on the other hand, the property of being far more excited by the reaction of iron, so that a straight copper wire can be excited by this reaction to a degree greatly exceeding that of a straight iron wire under precisely the same conditions. Some of Professor Hughes's experiments illustrating this point may be cited, as they are of much practical importance. A

copper and an iron wire of equal resistance, 1 metre in length, were measured for inductive capacity and resistance, the capacity of the copper wire being taken as 100, and the iron being 400. The copper wire showed an increased resistance, during the variable period, of 8 per cent, as compared with 128 per cent for iron; but a great change took place when each of these was placed in the interior of an iron gas tube of sufficient diameter to allow of the wire being insulated. The force of the extra currents in the copper wire then increased 350 per cent, while in the iron they increased 8 per cent, the force of the extra currents being now, for copper 450, and for iron 433.

The influence of an iron tube on the resistance of the variable period was still more marked. The copper wire which, without the exterior iron tube, had only 8 per cent increase, now showed 934 per cent; or, by direct measurement, 1 metre of this wire, during the rapid rise and fall of the current in the variable period, had a resistance the same as 10.34 metres in the stable period, — a much greater difference than was obtained with iron wire, which only showed an increase of 22 per cent. Thus copper shows three times the sensibility to an iron sheath which iron does, a fact of importance in electrical engineering. Iron is much less affected in self-induction by exterior influence than copper. Copper coils are much more sensitive to iron cores within them than iron coils, and the resistance of a copper coil may be in the variable period far more than that of an equal iron coil, if an iron core react within it. It is this fact, however, as Professor Hughes points out, which enables copper coils to be so effective in transforming energy in 'secondary generators;' and he remarks that a dynamo having its electromagnet and armature wound with insulated iron wire, would, irrespective of its resistance, have an extremely low efficiency as compared with one wound with copper. As regards the resistance of either of those wires, Professor Hughes observes that there can be no doubt that the resistance of the armature of a dynamo, or, in fact, of any coil of wire, as measured during the stable period, gives no approximate indication of what its real resistance is during the period in which it is doing work. This remark bears out a recent suggestion to the effect that the resistances of conductors, apparatus, and standards, as measured by battery currents in the stable period, differ to some extent from their values when traversed by the rapidly fluctuating currents of a dynamo. A further investigation of the matter is required in order to find out its practical importance, if any.

The following table shows the influence of an iron tube surrounding a straight iron or copper wire compared with compound wires: —

WIRES IN IRON TUBE, EACH 1 METRE IN LENGTH.	Comparative electromotive force of the extra currents.	Approximate comparative increased resistance during the variable period (that of the stable period being taken as 1.)
Copper wire 2 millimetres diameter, alone	100	1.08
Same wire insulated in the interior of the iron tube	450	10.34
Same joined in the tube at both ends	275	10.00
Same in contact with the tube throughout its length	200	7.83
Compound wire (copper interior with steel exterior)	325	4.35
Soft Swedish iron, 2 millimetres diameter, alone	400	2.28
Same wire insulated in the interior of the iron tube	433	2.78
Same joined to the tube at both ends	240	2.70
Same in contact with the tube throughout its length	215	2.60
Compound wire (steel interior, copper exterior)	107	1.20

This table shows that the iron tube has a much greater effect on the copper wire than on the iron wire, the effect in both cases being at its maximum when the tube is insulated from its central conducting wire; for, while the wire is in contact with its tube, there is evidently a shunt action, or eddy current, between the outer coating and the central portion. This Professor Hughes has measured by means of a telephone between the wires and its sheath, and also between two concentric sheaths. When the sheath is joined to the wire at both ends, the electromotive force of the extra current is reduced, but the resistance during the variable period is little altered. If, however, as in a coated wire, the wire and sheath are in contact throughout, there is a marked decrease in this resistance. Thus Professor Hughes is of opinion that the shunting effect takes place locally and probably transversely. The passage of an electrical current then takes place with less opposing resistance from self-induction than would be the case if there were no internal partial neutralization of the extra currents.

ORIGIN OF FAT IN ANIMALS.

SINCE the researches of Dumas, Milne-Edwards, and others on insects, and those of Persoz and Boussingault on geese, it has been established that the animal organism has the power of elaborating fatty matters. It was formerly believed that such

matters were received already formed with the food, and that the *rôle* of the animal organism was merely to accumulate them. The vegetable organism, it was thought, was alone able to form them.

In comparing the quantities of fat stored in the bodies of those animals experimented upon with those known to have been introduced with the food, they were found to be considerably greater. It was shown, that, of the thousand grams daily increase in weight of an ox, six hundred or more were due to an accumulation of fat, while the ingested matters contained less than half of that quantity; so that it is rendered certain that a large proportion, if not all, of the fat in the animal body, is due to sources other than fatty foods. What these sources are, is an important question, the answer to which has not been satisfactory. It has commanded much attention, especially in Germany, within late years, and has given rise to numerous controversies. It is a subject, also, of no little importance, since obesity in man is often an infirmity, and sometimes a grave disease. It will therefore be of interest to present such facts, in connection therewith, as have been so far experimentally demonstrated, as given by A. Sanson in the *Revue scientifique*.

Pettenkofer and Voit kept during a number of days, in a suitable respiration apparatus, a dog which received daily given quantities of dried starch and fat, and ascertained that the dog eliminated, under the form of carbonic acid, not only all the carbon of the ingested starch, but also a portion of that of the fat. It was therefore concluded that the starch thus decomposed did not serve in the formation of the fat. This formed the basis of a theory, on Voit's part, that the formation of fat was due to the reduction of albuminoid matters by the oxygen of respiration. According to this theory, the alimentary substances which we call carbohydrates — that is to say, starch, glycogen, sugars — take no part whatever in the formation of fat. These are decomposed in the organism, furnishing material for the animal heat, and resolving themselves into carbonic acid and water. The albuminoid matters — the proteines — are only in part thus decomposed, and furnish, besides, urea and fat.

This theory of Voit, which was in reality a very ingenious hypothesis, was immediately accepted throughout Germany, though Henneberg showed by chemical calculation that 100 grams of albumen thus used would not furnish more than 51 grams of fat in addition to 33 of urea and 27 of carbonic acid. It is necessary to remark, however, that, in the numerous experiments performed by Voit and his disciples in support of this hypothesis, they were not able to verify it directly. It is impossible, in fact, to sustain the life of an animal nourished exclusively by albumen.

Taking as a point of departure the data of Henneberg's calculations and the facts established by the experiments, it has not been difficult to show that Voit's hypothesis is inadmissible by reason of its impossibility. The geese upon which Persoz experimented were found to have formed over 4,000 grams of fat, while their food, completely deprived of fat, contained but 1,400 grams of proteine, — a quantity sufficient to form but a little more than 700 grams of fat. Other experiments of the same nature show the impossibility even in a more striking degree. A cow which gained at the rate of 1,600 grams per day stored up daily nearly 1,000 grams of fat, but an analysis of the food with which she was supplied showed only sufficient albuminoid matters to furnish about half that quantity.

These and other experiments have established reasons, now generally received, for the belief that herbivorous animals do not depend upon albuminous foods for the sources of fat, but that the fat is in a large part derived from the carbohydrates.

Very lately Rübner has repeated the researches of Pettenkofer and Voit, and reached opposite results. He placed in the respiration apparatus a small dog weighing a little more than six kilograms, and gave it food composed of 85 grams of starch, 100 grams of cane-sugar, and 4.7 grams of fat. During ten days, in which it was kept under these conditions, it was found to have eliminated 87 grams of carbon. The entire quantity of carbon introduced by the food was 176 grams, of which 89 were retained in the organism, and served in the formation of fat, 76 of which must have been derived from the carbohydrates. From these facts he concludes that the carbohydrates are demonstrated to be a source of fat in the carnivores as well as in the herbivores and omnivores. These researches of Rübner destroy absolutely the value of those by Pettenkofer and Voit; and one can feel assured that the German theory of the dependence exclusively upon albuminoid matters in the formation of fat in the animal organism will no longer obtain acceptance. In these organisms, as in the vegetable, the fatty matters are formed by the carbohydrates furnished in abundance in the food.

No more definite conclusions, however, in regard to the proper composition of food to produce fattening, can be reached from a knowledge of these facts. In alimentation every thing depends upon digestion. Every thing must be adapted to

the individual aptitude, and the proportions of carbohydrates and albuminoid matters must bear mutual relations dependent more or less upon physiological processes. Too strong or too feeble, as regards the digestive power of the individual considered, the proportion of the carbohydrates exerts an influence either upon its own digestibility or upon that of the albuminoids which accompany it; and in either case it has a depressing effect upon digestion. But, as regards a regimen preventive or remedial of obesity, the case is different. It is evident, that, if the formation of fat is dependent upon carbohydrates, a diet composed largely of them, so often practised, can only be an error so far as obesity is concerned.

A DARING ECONOMIST.

THIS is a day of free lances in political economy. Its doctrines, its premises, its methods, are being subjected to every conceivable kind of criticism; but, of all the kinds, that represented by Mr. Patten's book is perhaps the rarest. He adopts the deductive method of English political economy, and in the main adopts also its premises; but by throwing special emphasis on such of these premises as he conceives have been insufficiently borne in mind, as well as by insisting on some others which he himself introduces, he arrives at most important conclusions very much at variance with those commonly accepted. But it is not so much this position which we have just outlined that makes the book somewhat exceptional, as the fact that Mr. Patten unquestionably understands the doctrines which he criticises. Not only does he understand them, but he gives ample evidence of such logical acumen and practical insight as might fit him to contribute to the improvement and extension of economic knowledge. Yet we are compelled to say that his book, on the whole, is most unsatisfactory; that while a reader who is well versed in economic theory, and who keeps himself constantly on the guard against the author's calm confidence in the completeness of his own argument, may find in it some suggestions which would repay attentive study, to the general reader it is full of snares and pitfalls.

We have touched upon the secret of the author's failure to produce a sound contribution to economic criticism. He seizes upon a feature which seems to him to have been slighted by previous writers; he drags it to the light, and wishes to compel a recognition of its importance in order to give the theory a completeness which it did not before possess; in his eagerness to do this, he comes to look upon his own supplement as the complete doctrine; and what in due subordination to the old teachings might have been a useful idea, becomes in this way a source of confusion and paradox. The author, moreover, exhibits a large share of that quality which has so frequently destroyed the utility of economic writing, — a disposition to exaggerate the differences between his own views and those of previous writers, — and, in his ardent pursuit of the consequences of a pet notion or discovery, loses sight of the principles which he elsewhere shows he has understood. The only safeguard against defects of this sort is a profound sense of one's own liability to err in matters of so subtle and complicated a nature as those with which our author deals, and such a feeling of respect for the great thinkers of the past as would compel one to examine a question most carefully from every point of view before deciding that they were in the wrong. This is not the spirit that animates Mr. Patten: his book is full of bold statements of fact and theory, for which the author seems to think that no further justification is necessary than that they fit in easily with the general considerations which, from his point of view, are most prominent. The result is, that, in addition to a sketchiness and incompleteness quite inconsistent with the weighty character of the subjects discussed, the book is marked by logical oversights of the gravest nature, which almost or quite neutralize the effect of the author's ability.

To justify this estimate of his book by an examination of the several arguments advanced by Mr. Patten would require an amount of space not much less than that occupied by the book itself. We must confine ourselves to one or two illustrations. The first chapter is devoted to a criticism of the Ricardian doctrine of rent. The principal objection here advanced against the theory rests on the fact that the extension of the field of cultivation requires an initial expenditure for clearing the land and fitting it for agriculture. This expenditure will not be incurred unless the owner can expect to receive as rent the ordinary profit on his initial expenditure of capital; but, the expense once incurred, the land will not be withdrawn from cultivation as long as it can merely yield the usual return for the labor and capital annually expended upon it. "It is clear, therefore," says Mr. Patten, "that the laws which regulate the bringing of new lands into cultivation, and those according to which land will be withdrawn from cultivation, are very different, and that there is a large margin within which the

The premises of political economy; being a re-examination of certain fundamental principles in economic science. By SIMON N. PATTEN. Philadelphia, *Lippincott*, 1885. 12°.

price of food may vary without a change in the quantity produced." A little reflection will show that there is a fatal oversight in this argument. It is true that people will not incur a considerable expense in preparing new land for cultivation unless the price of produce is sufficient to enable it to pay rent; but there is no reason whatever to suppose that the land so brought into cultivation is the worst land in use. There might be a considerable fall in the price of food before the land last brought into use at great expense was thrown out of cultivation; but other and worse land would be thrown out of cultivation, or, what is the same thing economically, it would be less completely cultivated. If the Campagna were drained, no one supposes it would be the worst land in Italy; and, although a considerable fall in the price of Italian produce might afterwards take place without throwing the Campagna out of cultivation, this is not the same as saying that no land in Italy would be thrown out of cultivation. Mr. Patten thinks that the consideration of the expense of bringing new land into cultivation shows that there is no land which does not pay rent: in reality it merely shows that what is chronologically the last land to be cultivated is not always the land which pays no rent. In this, no Ricardian will be disposed to quarrel with him.

Strange to say, Mr. Patten, throughout this chapter, altogether ignores the possibility of reducing production by applying less capital to land, which is economically equivalent to withdrawing bad land from cultivation. In one of the last chapters he denies the truth of the law of diminishing returns; the law, namely, that after a certain point additional applications of labor and capital to a given portion of land yield a smaller return than former applications did. If Mr. Patten's position on this point were correct, the Ricardian theory would be sadly shaken. Mr. Patten fancies the true law to be that of limited returns, not diminishing returns; and, this fancy having taken hold of his mind, he devotes the main part of a chapter of thirty pages to trying to show that "the proportional return might increase up to a point beyond which no additional return could be obtained by any amount of labor." This is as much as to say that it would pay a farmer to apply all the care and all the expense required for fertilizing, draining, watering, and so forth, which was requisite for getting from the soil the largest amount of produce it was physically capable of producing. The position is disproved by the practice of every plain farmer, and by the experience of every 'model' farmer; and only the fatuity of a man in love with his own 'discovery' can account for Mr. Patten's curious effort to prove the contrary. In point of fact, he does not always bear in mind what it is that he is contending against, as when he says (p. 160), "If no other result were obtained from improved processes than this better utilizing of labor, this result would more than counteract any tendency there may be towards diminishing the return from agriculture." This is not in the least pertinent to the question; what economists assert is, that, with *given* processes, capital and labor applied to the soil beyond a certain point produce diminishing proportional returns.

The third chapter is devoted to a consideration of the law of population. One of the worst cases of easy-going refutation which occur in the book is furnished by the way in which Mr. Patten disposes of the method by which Malthus arrived at his conclusion. "He found that in new colonies, where the tendency has the fewest checks, population frequently doubles itself in twenty-five years, and then concluded that this rate of increase represented the natural force of the tendency, and that this was the rate at which population always tends to increase. There are many objections to this method of reasoning which will quickly appear when we apply it to the investigation of other subjects. . . . By the same method of reasoning we could prove that all men are natural drunkards, cannibals, adulterers, and murderers, since we find communities in various parts of the world where drunkenness, cannibalism, etc., are common." A schoolboy ought to perceive the difference between the two cases. What Malthus found was, that men of the same race, the same civilization, the same religion, the same traditions, multiplied at a much more rapid rate when placed in circumstances which permitted of the easy support of an increasing population than they did when living in an old and thickly settled country. The differences in the rate of increase were observed in the case of like peoples — often of the same people — in different circumstances; and it is ridiculous to put this on a level with a comparison between totally different peoples. If Mr. Patten had reflected that Malthus was neither a fool nor a vain man, but a man profoundly impressed with the importance of arriving at the truth concerning the law of population, he would have been slow to suppose that Malthus' position could be so easily overthrown: and if, after writing his chapter, he had carefully re-read his Malthus, he would have found that most of his criticisms had been very thoroughly answered by Malthus himself.

We shall look at one more example of the way in which Mr. Patten, in spite of understanding an economic law, goes astray through an unques-

tioning confidence in any apparent correction of it which may occur to him. He says that economists justly call attention to the waste of labor and capital caused by protection, but that they omit to notice a precisely similar waste, on a much larger scale, which is produced by free trade. To illustrate his point, he says, that, if Portugal has an advantage over France in the production of oranges, then, if a protective duty caused the planting of a few orange-groves in France on land which might have been more productively employed otherwise, economists would cry out against the waste. But the same effect may be brought about by free trade, if the world's demand for oranges is so great that the appropriate land of Portugal and similar countries is insufficient to supply it; the French land is then brought into requisition through the operation of free trade; and yet the economists make no outcry against it, says Mr. Patten, though the land is as surely diverted from its best use as it would be by a protective tariff. But precisely here is Mr. Patten's fallacy. There is no natural unit for comparing oranges with any thing else, as grapes, for example. What is meant by saying that on a given piece of land we can raise more grapes than oranges? Simply that the crop of grapes has more commercial value than that of oranges. When the demand for oranges has increased, the same quantity of oranges has a greater value than before, and the land is now better adapted for oranges than for grapes. Mr. Patten forgets that the Frenchman could still raise grapes as before: he prefers to raise oranges because the world at large will give him more for them than for the grapes. Mr. Patten may, indeed, reply, that, in point of fact, the grapes were capable of doing more good to the world than the oranges; but economists do not assert the contrary of this, or pretend that production is regulated by any absolute standard of utility. They know very well that people do not produce what is best for their fellows, but what their fellows most desire.

The title of Mr. Patten's book does not convey a correct idea of its contents, for it deals quite as much with questions of social improvement as it does with the primary laws of political economy. If we look in it, not for fundamental criticism, but for suggestions of additions to economic theory, and still more of improvements in economic practice, we may find, as already intimated, a number of things that would well repay attention. The importance of attending to the results of different economic arrangements in determining the character of the individuals who will survive and perpetuate their kind is made justly prominent throughout the book, and is probably its most valuable feature. It is not, however, carefully and impartially worked out, but is everywhere intermingled with the misleading criticism of economic doctrines which we have endeavored to characterize. In the discussion of free trade, Mr. Patten rightly calls attention to the importance of inquiring into its effects on distribution, the effect on production alone not being decisive of its desirability; and in various parts of the book there are suggestive remarks on the bad influence of a low rate of interest upon the chance which the poorer classes have of improving their condition. But both in discussing these matters and in proposing remedies, the author is almost always content to follow out the consequences of a single idea, instead of giving the subject that sober and comprehensive consideration without which no discussion of this nature can be useful, except by way of suggesting to others who are more careful, and more free from prepossessions.

THE annual report of the North Carolina experiment-station for 1885 deals almost wholly with fertilizers and soils; but an experimental farm is about to be established in connection therewith, so that henceforth greater attention will be devoted to other less strictly chemical subjects. The station was established chiefly to give protection to the farmers of the state in the purchase of fertilizers, and its utility seems proved by the marked increase in value of the fertilizers in the market, and the rapid decrease of their actual cost price. Among the fertilizers to which attention was directed, are cottonseed-hull ashes; and it is of interest to note that the total possible annual output of these ashes in the United States is estimated at over twenty-five thousand tons, valued at over eight hundred thousand dollars, though less than half this amount has hitherto been actually obtained. The vast quantities of phosphatic rock lately discovered in the state have drawn attention to the possibility of utilizing the pyritic deposits for the obtaining of sulphuric acid, to be used in the manufacture of fertilizers. A report by Mr. A. Winslow advances the opinion that the plan is deserving careful attention. Should it prove practical, Carolina, as well as other southern states, will be benefited very materially in its agricultural industries.

— It is said that experiments have been successfully made on the Indus valley railway in running locomotives fired with petroleum, and that it seems likely that the frontier railway-engines will before long derive their fuel from the oil-wells near Sibi.

SCIENCE.

FRIDAY, MAY 21, 1886.

COMMENT AND CRITICISM.

THOSE PEOPLE who have thought that Englishmen had already formed a society for every charitable purpose under the sun are now shown to have been mistaken. A society has just been organized for providing amusement for children. Of the eighty thousand children in London who leave the elementary schools every year, only four per cent have been willing to continue their education in the evening classes which have been provided by the education department. This unsatisfactory state of things has led to the formation of the Recreative evening schools association, whose object is to offer the children, who have been at work during the day, such an enticing evening programme that they will find it impossible to stay away. There are classes in musical drill, song, wood-carving, modelling, and drawing, with lessons in history, geography, and science, illustrated by the magic lantern. The idea is an excellent one. An education which 'children will cry for' is the ideal towards which education at all ages should approach as nearly as possible; and until that ideal is reached, the educational reformer will not find himself without an occupation. Sowing and reaping have not come any nearer in these days to being as great sources of enjoyment as foot-ball and tennis; but schools are very different from what they were when our fathers were young, and it is quite possible to hope that we shall learn in time how to give children a life of purely happy activity.

COMPLAINTS OF THE OVERCROWDING of the medical profession in the United States are constantly becoming more numerous, and there is certainly some ground for them. When the relatively greater increase in the number of graduates than of the population is taken into consideration, there is every reason to fear a far more severe struggle for existence as the lot of the average physician in the near future. Statistics give 3,675 as the number of medical students graduating in 1885, and the number will probably be increased the present year. Already the United States has a larger proportion of physicians to its population than any other country in the world, averaging one to less than six hundred. To keep up this proportion, taking into consideration the natural increase of population, an annual increment of but little more than two thousand annually would suffice for some years to come. It is evident that a large part of the yearly graduates must either drop out by the wayside, or struggle for a very moderate subsistence.

But for this actual and threatened overcrowding there is a remedy whose necessity and importance are fast being recognized; viz., stricter requirements on the part of the state and of the medical colleges. The requirements for graduation in many medical institutions have been disgracefully lax: a few months' attendance upon lectures, an oftentimes worthless certificate of study, an hour's superficial examination, and the candidate is admitted to the degree of doctor of medicine. But it is interesting to observe the appreciable effects of state legislation in this direction. No one factor has exercised so much influence in elevating the standard for medical graduation as the action of the Illinois state board of health. Illinois was a good place to begin, for no city in the world turns out more irregular practitioners than Chicago; and the board of health, by securing the passage of laws requiring the registration of physicians with evidence of fitness as shown by the possession of a diploma from some college of a given grade or by examination, has undoubtedly exerted wide-spread influence. The number of graduates in 1885 was less than in 1884; and nearly every college, ostensibly at least, now requires a preliminary examination; and not a few have raised their standard of requirements for graduation, and lessened the number of their graduates.

THE SUBJECT of industrial education in common schools has been often broached of late, and any able work upon it is sure to attract attention. There lies before us a pamphlet on this subject by H. H. Dinwiddie of the Agricultural and mechanical college of Texas; but we are compelled to say that it sheds no new light on the

question. The author thinks the times are out of joint; and he is grieved that so many men have difficulty in earning a living. "The benevolent heart," he says, "is tortured by the cruel deliberation of natural selection, with its inexorable logic." "Shall thousands of young men walk the streets of our cities with their high commencement-day hopes ever sinking, till despair and gnawing hunger throw over every noble aspiration, and drive them to lives of infamy or death by suicide?" The conclusion is, that, if the young were taught the methods of industry at school, they would afterwards have no trouble in earning their living. We expected, therefore, to find the author advocating the teaching of mechanical trades in the common schools, as many others have done. As a matter of fact, he doesn't advocate industrial training at all: he only advises that the methods of the various industries should be described to the students, just as objects in natural history are described, but without any manual practice by the students themselves. How this is to help them in earning a living, we are unable to see; but it is the sole outcome of Mr. Dinwiddie's pamphlet.

THE INTELLECTUAL MOVEMENT IN JAPAN.

EVERYBODY in America who knows at all that there is such a country as Japan in the far east ought to be aware by this time that great social changes have for a past decade or two been going on among us. And numerous books and articles on Japan which have appeared within recent years in America, ought to have made tolerably clear of what nature these changes are. Thoughtful persons must often have wondered from afar whether these reforms are permanent, whether the spirit of progress does not lag sometimes, whether the people who seem to be rushing on with a headlong pace do not at times look back with longing on their past. If such persons had taken the trouble to look into the matter three or four years ago, they would have discovered that their surmises were correct. At that time we seemed to have turned round suddenly in the path which we had been so eagerly pursuing. People had started with the idea that all things European were good, and all things Japanese were bad. As they went on trying one sweeping change after another, they began to discover naturally that there were many blots in the European form of civilization, especially as imported into oriental countries, and that many things Japanese were not bad at all, but excellent, and even surpassed their European counterparts. This discovery, helped also, to some extent, by compliments, which foreign visitors are ever willing to pour on us, carried the people's feeling to the opposite extreme. They said to themselves, "We are not so very bad, after all. Why should we change? Let us have back our own familiar ways and things." The revival of old things became the order of the day. Chinese ethics began to be studied again with fervor, and the doctrines of Confucius and Mencius reigned supreme once more in the moral world. There was a revival of old Japanese literature and traditions. Women were to be brought up in the old-fashioned strait path: they were not to be allowed to catch hold of any new-fangled European ideas. *Utai* (a peculiar kind of singing) was heard again on all sides, and brought back old associations. Teachers of *cha no yu* (the art of making tea, including all the formalities attending its drinking, etc.) were in requirement on every hand, while masters of the Ogasawara school of etiquette bustled along with smiling countenances. The fashion was to give banquets in the old Japanese style, and restaurants *à la europienne* felt it to be very hard times. Young men were seen on the street, carrying about fencing-apparatus, — a sight not seen since the old feudal days. Schools of *jû jitsu* (a kind of wrestling) sprang up into existence by dozens. Various weapons of the *saumrai* which had been hung up in dark corners, again saw the light, and each claimed its own votaries. In short, all reforms seemed to be at an end for the present.

It must not be supposed, however, that all these carried us very far back. The backbone of old Japan — feudalism — had been shattered beyond all hopes of recovery; and, without that, things could not be made to work as in former days, however much minor matters might be patched up. Neither did people care to go back quite so far. Those who looked beneath the surface could easily see that this period of reaction could offer but a temporary check in the way of reforms, being comparable simply to the rest-stages observable during earlier developmental phases of many an animal. In fact, it proved to be of a very short duration. And who shall regret that there was just at that time partial retracing of the path we had been following, since it will prove to be the means of preserving many harmless arts and accomplishments peculiar to Japan, which might otherwise have been lost forever?

At the present time we may be said to be fairly in the midst of the second period of activity. We seem to be just as eager as ever to pursue the course of reforms; perhaps a little more so, for

the short respite we have had. The reforms that were accomplished in the first period were in many respects but superficial and material, or concerned only larger affairs of state; as, for instance, the establishment of telegraphic and postal service, opening of steamship lines, re-organization of the army and navy, reforms in the method of administering justice or of managing schools. They have left the feelings and thoughts of people comparatively untouched so far; but such stupendous changes could not take place without producing profound effects on the national life. And the present aspect of things makes it seem likely that during this second period of activity there will be great transformations in the innermost life of Japan. There will come to be healthier and sounder views in regard to family ties; and some, at least, of the abuses which disfigure the domestic life, we may hope will pass away. Woman's position will be better, and the gentler half of the nation will gradually come to exert more influence in society. New ideas will penetrate even to the very hearth-stone — or, rather, will lead to the establishment of a great institution known as the 'hearth,' which plays such an important part, both materially and metaphorically, in the life of Europe and America. The result of all these and other reforms will be to draw the Japanese closely into the comity of nations, and to make us share the feelings and thoughts of the civilized world, and to let the civilized world share our thoughts and feelings. In the opinion of many, we shall surely go down, if we could not accomplish this: it is our only chance of survival in this world of keen struggle, which seems to be raging just now in this part of the globe with more bitterness than elsewhere.

Of the reform movements which have been started since the last period of reaction, none is likely to be more beneficial, or more wide-reaching in its effects, than the movement initiated by the Roman alphabet association (*Roma-ji-kai*). This society has for its object nothing less than a complete revolution in the manner of writing the Japanese language. It proposes to substitute the twenty-six letters of the Roman alphabet in place of Chinese ideographs now used. To understand the meaning of this movement, we must explain how Japanese has been and is being written. In more formal kinds of writing the classical Chinese style is adopted. Chinese ideographs alone are used, and sentences are constructed as in pure Chinese. A scholar of that country will have no difficulty in understanding it. It must not be supposed, however, that a Japanese reads this in the way a Chinese would. A sentence being composed simply of a series of symbols, each of which stands for an idea, a Japanese translates it offhand, and reads it in Japanese, giving to each word its appropriate case-endings or inflections, which are not at all to be seen in the writing. This style of writing is now used much more sparingly than in former days. The most prevalent form of writing at the present day is a mixture of Chinese ideographs with the Japanese *Kana* syllabary; that is, ideographs are used to represent principal ideas in a sentence, and what might be called connectives are given in *Kana*. For instance: in the sentence, 'A dog killed a cat,' the main ideas conveyed by the words 'dog,' 'cat,' and 'kill,' are given in Chinese ideographs; while the particles that make the word 'dog' the subject, and the word 'cat' the object, of the sentence, are given in *Kana*, as well as the tense-endings of the word 'kill.' A small part of literature especially meant for the illiterate is in the Japanese *Kana* only.

Such being various methods of writing our language, it is absolutely necessary for a Japanese to learn a few thousands of Chinese ideographs before he can read or write at all fairly. And be it understood that to know the meaning of each character is not enough. To get at the complete natural history of an ideograph, one must first of all know, of course, its meaning or meanings. Then he must know the sounds which the Chinese gave to it. Of these, each character has at least two, — the sound it had when it was first introduced into Japan from Corea, the *go*-sound; and that which it had in a certain part of China when some Japanese visited it some centuries later, the *kan*-sound. Then he must know various ways in which this ideograph is written, — the printed, the 'cursive,' the 'grass' forms, — for, in writing, each ideograph is not generally given with its regular and full strokes, but is somewhat abbreviated. If there can be unreadable handwriting with only twenty-six letters to work with, imagine what it must become when there is a chance of mangling thousands. In addition to all this, every respectable person has to write ideographs with some degree of decency; with power and feeling, if possible, for penmanship almost amounts to painting, and does actually have, in the eyes of many, an equal value with it as an art. The simple task of mastering writing and reading becomes thus no mean one. If there were any proof needed of this fact, beyond the mere statement of the case, it lies in the fact that numerous as are the foreigners who have lived in Japan, and have fairly, or in some cases perfectly, acquired the spoken language, those who have mastered writing and reading can be counted on one's fingers.

When it is remembered that for a Japanese who wishes to keep abreast of the world, and to become acquainted with modern learning, the additional knowledge of at least one, or, if possible, of two or three, European languages is absolutely essential, thoughtful persons may well pause, and ask what time there is left for us for mastering many arts and sciences which go to make up modern life. In this world of keen struggle for existence, shall we not necessarily lag behind all other nations, if we are so occupied with mere symbols, and not with ideas themselves? That this state of things is most undesirable is admitted on all sides. In former leisurely days, when learning was a luxury in the hands of a privileged few, the harder it was made, the better. But we are now in the days of universal education, and what can we possibly accomplish with this clumsy and ponderous machine of bygone days? Clearly, something must be done, and this quickly. That such is the opinion held by all intelligent persons, there can be no doubt. The question is, what is to be done?

Some years ago a movement was started by which it was proposed to dispense with Chinese ideographs altogether, and to use the Japanese *Kana* syllabary only. The *Kana-no-kai* (the *Kana* association) was formed. The association has some three or four thousand members, and has done very good and earnest work, although, of late, eclipsed to some extent by its younger sister, the Roman alphabet association.

If the *Kana* alphabet alone should be used, it would certainly be a great improvement on the present method of writing Japanese with Chinese ideographs; but, in the opinion of many, the *Kana* is not equal to the demands of modern life. Springing originally from Chinese ideographs, it partakes somewhat of their clumsiness. A printed page of *Kana* is frightfully monotonous; there are no strokes that project out above or below the average width of letters: and taking in a word at a glance, without going over its component letters, is rather difficult. Again: although phonetic to some extent, spelling in it is really as bad as that of English words. There are many ways of writing down the same sound, and to know how a given word should be spelled becomes very difficult. For instance: there are eight different ways of writing the sound *Kō*, the same number of ways in writing *ō*, four ways of putting down the sound *mō*, five ways of writing *rō*, etc., and these are by no means exceptional cases. Think of the word *chō-chō* being written *tefu-tefu*. It is very difficult to write a scientific treatise in Japanese, anyway; but it is doubtful if it is possible to do so in *Kana* at all. The few attempts that have been made so far must be pronounced failures. The *Kana* alphabet has no doubt the merit of being known almost universally, and it is certainly at the present day the best vehicle of propounding simple ideas to the masses. But unless radical reforms are carried out in the method of writing in it, and several more symbols are newly added, it is not, in my opinion, equal to the demands of modern civilization.

The Roman alphabet has, on the contrary, all the facilities of the *Kana*, and possesses several additional advantages besides. Its twenty-six letters are very easy to learn, and its adoption will make reading and writing a very simple task; in fact, almost nothing compared with the present method of using Chinese ideographs. It will, of course, cause education to spread wider. It will save several years in every schoolboy's life. Those which he has to spend in the drudgery of learning how to read and write, he will be able to give to acquiring solid ideas of modern knowledge. The adoption of the Roman alphabet will also make the introduction of scientific terms and symbols into our language very easy. They have simply to be transferred bodily, with only such changes as the nature of our language makes imperative. Think what this means in mathematics, physics, and chemistry, or in writing down the scientific nomenclature of zoölogy, botany, and mineralogy. Geographical names and other proper nouns can be put down accurately, and not in imperfect approximations. Last but not least, the Roman alphabet being the one in which the literature of the civilized world is written, familiarity with it will make the acquisition of European languages comparatively easy; and, if Japanese be written in it, foreigners will have no difficulty in mastering reading and writing our language,— a task which they find now so utterly impossible. Thus the adoption of the Roman alphabet will help us to know others, and help others to know us. In short, it will make us kin with the rest of the world.

All this has been reasoned out time and again by persons who gave thought to the subject. But the stupendousness of the task of revolutionizing the whole written language of a nation deterred any from taking practical steps, and it is a matter of doubt whether any such attempt made before its own time would not have been laughed down. But when the period of reaction referred to in the beginning was over, and the march of reforms was resumed with as much eagerness as ever, the time seemed to many to have come for starting the movement of introducing the Roman alphabet as the means of writing our language. Every

thing seemed ready, especially as the *Kana-no-kai* (the *Kana* association) was already in the field, and making the urgency of radical reforms in the mode of writing a familiar idea to everybody.

The Roman alphabet movement originated principally within the University of Tokio. The first meeting for the purpose of organizing an association to carry on the movement was called on Dec. 2, 1884, at which seventy persons were present. The work of organization was completed early in the following January. A committee of forty, including several well-known foreign scholars, was then appointed to draw up a scheme of transliteration (adapting Roman letters to our sound). As Japanese does not contain any very peculiar sound, this task was comparatively easy, although it was not until after some heated discussion that the committee could come to a decision. The committee, wisely it seems to me, seized on what was already in vogue, — for of course Japanese had been written with the Roman alphabet before this,— and fixed it into a convenient and simple scheme. The system adopted is very much like that of Dr. Hepburn, the venerable American missionary who published some years ago a Japanese-English dictionary. With the completion of a transliteration scheme, the Roman alphabet association, or *Roma-ji-kai*, as it called itself, was in fair working-order. Its publications, setting forth its objects or explaining its scheme of transliteration, were cast broadside. The association was received with enthusiasm, and was a great success from the first. In June, 1885, — that is, six months after its organization, — its members numbered 2,904 persons; in December of the same year, 6,202 persons; and at the present date of writing, the membership is about 7,000. These belong to all parts of the country, and are from every station in life, from cabinet-ministers to story-tellers. In the first meeting, held in December, 1884, there were present only 70 persons. In the general meeting, held in January of the present year, the large Central hall of the Engineering college in Tokio was filled. At least 1,200 persons listened to interesting addresses made on that occasion by Count Inouye, the minister of foreign affairs, and by the Hon. F. R. Plunkett, the English minister in Japan. The association publishes a monthly magazine, named *Rōmaji Zasshi*, and distributes it gratis among members. It contains essays on all sorts of subjects by well-known writers, besides the transliterations of extracts from popular books. In it the entire practicability of writing Japanese with the Roman alphabet has been demonstrated. The association is also having a Japanese dictionary compiled.

Some of the newspapers make a practice of printing a small part of their issue in Roman letters, and thus aid in familiarizing people with it. In some provinces local societies have been organized to cultivate the use of the Roman alphabet.

The movement is likely to make its way fastest among scientific publications. Already the Tokio physico-mathematical society publishes its proceedings in the Roman letters.

Stupendous as is the task which the Roman alphabet association has before itself, its friends are sanguine that it will accomplish its purpose. The prospects are very favorable in every respect. For instance: the Department of education some time ago sanctioned the teaching of English in primary schools. The knowledge of English, of course, implies the knowledge of reading and writing Japanese in the Roman alphabet. Let the Roman alphabet be taught in public schools, and in a generation or two we shall have accomplished the desired reform. If the change were toward any thing very difficult or disagreeable, it might be hopeless. As things are, however, the prospects are very bright.

From the first, foreigners have been in favor of the movement, and have furnished some very useful and active members. Altogether several hundred, including diplomatists, editors, missionaries, teachers, scientific men, are enrolled in its membership list. The association has also received pleasant recognition abroad from newspapers and societies. Conspicuous among this stands the action of the London philological association. At the meeting held Dec. 18, 1885, that learned body passed a resolution of sympathy with the Roman alphabet movement in Japan, moved by Dr. Furnisvall, and seconded by Professor Skeet, the president, and Henry Sweet, the philologist.

The Roman alphabet association has thus accomplished a great deal in one year of its existence. As in all similar undertakings, it suffers from lack of funds. This alone limits the sphere of its activity and usefulness. K. Mitsukuri.

Tokio, April 23.

THE AMERICAN CLIMATOLOGICAL ASSOCIATION.

The third annual meeting of the American climatological association was held at the College of physicians, Philadelphia, May 10 and 11, Dr. William Pepper presiding. The opening address of the president was devoted to the subject of the distribution of phthisis in Pennsylvania. The president reviewed the results of similar investigation by Dr. Bowditch in Massachusetts. Dr. Bowditch had found a remarkable correspondence

to exist in Massachusetts between the death-rate from phthisis and the dampness. Dr. Pepper had conducted a similar investigation in regard to Pennsylvania by means of a series of questions addressed to physicians throughout the state. The answers received were somewhat meagre and unsatisfactory, but were sufficient to show certain remarkable facts. The relation between phthisis and dampness was not so clearly shown as in the case of Dr. Bowditch's investigation. As a general rule, the counties of high elevation and sparse population made the best showing. The most striking fact, however, was the remarkable correspondence between the areas of least death-rate from phthisis and the areas of standing hemlock: they seemed to be almost exactly coterminate. In those towns where the mortality was found to be low, the death-rate was increased in those parts which lay along rivers and in swampy regions, and where the cellars of the houses were damp. The direction of the prevailing winds seemed to have no bearing upon the amount of phthisis. The opinion of the physicians addressed in regard to the influence of heredity in phthisis appeared to be almost unanimous, only 7 out of 94 denying it.

Dr. A. L. Loomis read a paper upon the effects of high altitude on cardiac disease, in which he reported several cases of various cardiac disorders, where a sudden change to a high altitude seemed to hasten the fatal event. The doctor advocated extreme caution in making such changes.

Dr. I. H. Platt of Brooklyn read a paper upon the physics and physiological action of pneumatic differentiation, the purport of which was that the action of the pneumatic cabinet was similar to that of compressed-air apparatus, and that no more medicated vapor or spray can be carried into the lungs with the aid of the differential process than without it. The author believed the beneficial result of treatment by this method to be due to the reduction of congestion by the increased atmospheric pressure in the lungs and by the strengthening of the thorax by exercise, as well as to modified nutrition consequent upon the changes in the respiratory and circulatory functions.

Dr. Roland G. Curtin contributed an interesting paper upon the subject of Rocky Mountain fever. The fever commences with a chill, and a rise of temperature to 101 or 102, without the remission of typhoid. The skin is dry. The temperature may fall suddenly and rise suddenly. Quinine seems to be powerless. Delirium may occur, but it is not usual. There is no definite duration to the disease, and its tendency is to recovery: the absence of fatal cases prevents a knowledge of the pathology. The question seems to be unsettled, whether it is a separate disease, or a light form of typhoid.

A very important paper was presented by Dr. C. C. Rice, "How the therapeutic value of our mineral waters may be increased." The fact of so many patients going to the European springs to the neglect of the American is partly the fault of the medical profession in this country, and partly the fault of the owners of the springs. Americans are less acquainted with our own springs than with those of Europe. It is important, that, if the waters are used at all, they should be used intelligently. The general hygiene should be under the direction of a physician.

One of the factors which go to make the European watering-places famous is the mental effect of the vigorous course of training there in vogue. Contrasted with this is the social life at Saratoga and Richfield springs. People go to Carlsbad, not for fashion, but for the waters. The habits at the European watering-places are simple. American springs should be more thoroughly investigated by the profession, and the waters should be given their proper place in the materia medica. He offered the following suggestions in regard to the development of our springs: 1. Analyses of the waters should be made by competent chemists; 2. Clinical investigation of the waters should be made by physicians; 3. Care should be taken to select the special spring adapted to the case; 4. A careful history and diagnosis of the case should be sent with the patient to the local physician; 5. More rigorous discipline should be enforced; 6. Patients should be compelled to abstain from fashion and social dissipation.

Dr. Didima read a paper upon the health-resorts of Mexico. His paper was based upon communications from Mexican physicians, which were somewhat contradictory; but the facts seemed to be that the climate of Mexico was naturally favorable for the relief of phthisis, but its beneficial effects were offset by its lamentable lack of sanitary arrangements. Another drawback to the climate is the great difference between the temperature in the sunshine and in the shade.

'The southern Adirondacks' was the title of Dr. E. F. Bruen's contribution, who was a warm advocate of Blue Mountain Lake. This lake is surrounded by pine-forest, and the air is so pure that no dust is visible in the beams of sunlight. But little rain falls in the winter.

Dr. J. H. Musser discussed the question of the prevention of phthisis among mill-hands, and advocated the extension of the plan adopted by the Willimantic thread company, of supplying the mill-hands with wholesome and nutritious food,

which the experience of this company has shown to be advantageous from a financial as well as a humanitarian stand-point.

Dr. Dana discussed the relation of high altitudes to nervous diseases. He had investigated the subject by means of questions addressed to physicians in various elevated stations, and arrived at the following conclusions: choreiform manifestations are increased by high altitudes; nervousness and irritability are also increased; nervous women especially are rendered more nervous; the weight of opinion seems to be that old age is not prolonged by altitude; epilepsy is not increased, sometimes the patients improve; insomnia is usually benefited, often cured; the gouty diathesis is not helped by the change.

The officers for the coming year are, president, Dr. Frank Donaldson of Baltimore; 1st vice-president, Dr. V. I. Bowditch of Boston; 2d vice-president, Dr. R. G. Curtin of Philadelphia; secretary, Dr. J. R. Walker of Philadelphia.

PROGRAMME OF THE INTERNATIONAL PHILOMATHIC CONGRESS.

THE International philomathic congress, having for its object the discussion of commercial and industrial technical instruction, and opening Sept. 20, 1886, has arranged the following programme of questions for discussion: I. General questions: Present condition of commercial and industrial technical instruction in France and abroad; domain of this instruction; importance due it; its influence on the economic, commercial, and industrial condition of the country; general view of an organization of technical instruction; preparation for the various branches of this instruction; action of the state, general councils, municipalities, chambers of commerce, consulting chambers, syndic chambers, and private corporations: on the establishment of schools of technical instruction; on the elaboration of their methods and courses of instruction; on their government; on their financial organization; to what extent should technical instruction be provided with a general and uniform course? to what extent should it have special courses appropriate to the necessities of each district? what position should be allotted in the different schools of technical instruction to general instruction? what proportion is to be allotted to theoretical and what to practical instruction? relations among themselves of similar schools of technical instruction, with a view to common action respecting all general measures intended to aid their development, and assure their prosperity; concerning their representation in the superior council of technical instruction; periodicity of the congress for technical instruction; place and state of the next congress. II. Special questions: organization of commercial technical instruction, first degree (elementary commercial instruction), second degree (more advanced commercial schools), advanced degree (advanced commercial studies); organization of industrial technical instruction, first degree (workmen), second degree (master workmen and foremen), advanced degree (engineers); preparation and admission of the pupils; instruction by the master workmen; apprenticeship; schools; laws and regulations, courses, and methods; theoretical instruction and practical instruction; instruction in drawing; manual labor; staff of administration and instruction; councils of administration and improvement; buildings and material; plans and distribution of the buildings; instruments and material for instruction; libraries; commercial museums: industrial museums; financial organization; fellowships; scholastic excursions and expeditions; travelling fellowships and resident fellowships abroad; finding places for pupils after graduation; places and salaries; complimentary courses of technical instruction; courses for apprentices and adults; public lecturers. All information relating to the congress may be had of the general secretary of the Philomathic society at Bordeaux, Eugene Buhan.

NOTES AND NEWS.

WE have received a pamphlet of fifty-one pages on the Pennsylvania boroughs, which may interest some of our readers. It is written by William P. Holcomb, and forms one of the studies in historical and political science published by the Johns Hopkins university, the fourth series of which is now under way. The author begins with an account of the introduction of the borough system under William Penn, and then sketches the history of some of the leading boroughs, and concludes with a description of the borough system as it now exists. This method of local government is only found in three American states, — Pennsylvania, New Jersey, and Connecticut, — and citizens of other states have some difficulty in understanding what a borough is, and wherein it differs from a city. According to Mr. Holcomb, the difference is mainly one of size, ten thousand inhabitants being required, under Pennsylvania laws, to constitute a city, while a borough need not have more than a few hundred. Then a city in that state has two representative councils, while a borough has only one; and these two points, with a few differences in names, seem to be the only distinction between the two kinds of

municipalities. The author expresses some surprise that boroughs, which are so common in England, should be so rare in the United States; but, if they differ so little from cities, there would seem to be no particular need of them. Mr. Holcomb's work will doubtless be useful to Pennsylvanians and to students of municipal government generally.

— The U. S. coast survey has issued a new edition of the chart of Humboldt Bay, made from the most recent surveys; the third edition of appendices 12 and 13 of the report of 1882, on magnetic declination, by assistant Schott; the latest chart showing the entrance to New York harbor; and the tenth sheet of the District of Columbia map, made under the direction of the Corps of engineers by Assistant Doun. A new chart of St. John's River, Florida, from its mouth to Jacksonville, is in course of preparation. The New York bay entrance sheet, 8 A, is now ready for distribution to dealers.

— The Boston medical-school circles are at present agitated over the question whether the female medical students shall be allowed to attend the general surgical clinics in the city hospital, they having insisted upon that privilege by attending, and refusing to withdraw.

— The German secretary of state has published statistics on the periodicals of the world, from which it appears that there are 34,000, with a distribution of 592,000,000 copies; 19,000 are published in Europe, 12,000 in North America, 775 in Asia, 809 in South America; 16,500 are in English, 7,800 in German, 3,850 in French, and 1,000 in Spanish.

— MM. H. Fal and E. Sarasin, in a recent communication to the French academy of sciences, have supplemented their researches on the penetrability of light in deep water by the results of a series of observations in the Gulf of Nice, showing the relation that exists between the vertical and oblique rays of the sun in their power to reach to great depths. They found the limit of luminosity to be four hundred metres in mid-day of April, and that only for a short time. At eight o'clock in the morning its penetrability was limited by three hundred and fifty fathoms; at six o'clock in the afternoon the light reached less than three hundred metres.

— For a number of years past the city of Liverpool has been engaged, at much cost and trouble, in the perfection of her sewerage and house-drainage systems. The works are only just completed, but already very distinct results are evident in their influence upon the city's mortality. For the ten years prior to 1870 the death-rate per thousand of the inhabitants was no less than 32.5; between 1870 and 1880 the mortality had fallen to 28.4; and since then a steady and uninterrupted fall has been maintained, until, during 1885, it only reached 23.5.

— It is stated in the daily papers that Prof. J. Emerick of William and Mary college has discovered the aerolite which fell in Washington county, Penn., on Sept. 14, 1885. It was found embedded deep in the soil near Claysville, and is said to weigh fully two hundred tons, — a statement that needs confirmation.

— The members of the Chesapeake zoölogical laboratory of Johns Hopkins university left Baltimore on Thursday, the 20th of May, for Abaco, one of the islands of the Bahama group, where the summer session of the laboratory will be held. The party consists of Prof. W. C. Brooks (the director), Professor Mill, Dr. H. Orr, Messrs. E. A. Andrews, F. H. Herrick, H. V. Wilson, and two or three other students of Johns Hopkins.

— A favorable report has been made by the house committee on agriculture on the bill to amend the act creating a bureau of animal industry. The most important change is in section 1 of the present law, which is to be entirely repealed. The substitute offered proposes that the chief of this bureau shall be a competent veterinary surgeon, who is to investigate the condition of the domestic animals in this country, and inquire into the causes of contagious, infectious, and communicable diseases among them, and the means for the prevention and cure of the same. The bureau is further instructed to make special investigations of pleuro-pneumonia, foot and mouth diseases, and rinderpest in cattle. Two hundred and fifty thousand dollars are to be appropriated to carry into effect the provisions of the act.

— The first shipment of shad to the Pacific coast by the U. S. fish commission has resulted most successfully. Car No. 1, which left Washington last week in charge of Mr. J. F. Ellis, with a million young shad, arrived at Portland, Ore., with seven hundred thousand. This experiment of transporting shad so great a distance proves the practicability of shipping them in this way. Of greater interest to science, however, was the successful experiment of hatching the shad *en route.* Six hundred thousand eggs formed a portion of this western shipment, which were placed in four MacDonald jars. A pump was kept continually at work, moving the water, and fully ninety-five per cent of the eggs were hatched. Of the five per cent lost, most of them were due to premature

hatching. This is a most gratifying showing for the fish commission, which is constantly discovering and applying new methods in the science of fish-culture.

— The following comprise the recent changes in the coast survey service. Parties on the Pacific coast have all taken the field under instructions. Professor Davidson is at Portland, Ore., observing for telegraphic longitude, while Assistant Pratt is at Tatoosh Island, which point is made available as a telegraphic longitude station, from the fact that the U. S. signal service now has wires in operation from Port Angeles to that point. Assistant Whiting takes the field about June 1 in Massachusetts, to determine the changes at Cotamay, Martha's Vineyard. Assistants Smith and St. Clair are between Colorado Springs and Salt Lake City, engaged in telegraphic longitude determination. Parties in the south will shortly be closing their season's work, and will report to the Washington office for future field-duty. The geographical positions of the Borden survey of the state of Massachusetts, together with a great number of additional points determined by the coast and geodetic survey, computed upon Clark's spheroid, are ready for publication in the annual report for 1885.

— A report just received from the U. S. consul at Apia gives the following as the copy of a card found inside a bottle picked up on Palmyra Island, Nov. 26, 1885: "R. M. Str. Zealandia from San Francisco to Sydney, Lat. 7° 30′ N.; Long. 163° 30′ W." This bottle had drifted a hundred and one miles south by east.

— In Holland, where the public-school system has reached a very highly developed stage, it is now proposed to relegate primary education to the private schools. A measure to that effect has passed the lower chamber of the states-general, and has been withdrawn by the government for the purpose of removing certain objectionable features which caused its rejection by the upper house.

— The coldest place upon the earth, says *Ausland*, is Verchojansk, in Siberia. The coldest regions of Asia lie east of the Lena River, and the meteorological station at Yakootsk has recorded the lowest temperature ever observed. The average temperature for the year at that place is −17° C., and the difference between the summer and winter temperatures is not less than 64° C.; the average temperature in January being −49° C., and in July, +15° C. On Jan. 15, 1885, the temperature fell to −68° C.

— Recently published statistics of British India give the entire population (for 1883–84) at 253,982,595, and the superficial area at 1,378,044 square miles. 43,549,158 residences were enumerated. The density of the population reaches its maximum in Bengal, where there are 442.8 inhabitants to each square mile: the minimum is found in Central India with 59.3, and in British Burmah with 42.8, to each square mile. For every 130 males there are 124 females. The Hindoos and Buddhists include 190,000,000; the Mohammedans, 50,000,000; Christians, 1,800,000; Parsees, 85,000; Jews, 12,000; and various other sects with smaller numbers. The entire debt of India amounts to £171,577,945. In March, 1885, the entire length of railroads, in miles, was 12,000; of the telegraph systems, 23,341; the total length of wires, 68,694.

— A canal between the White Sea and the Baltic Sea has been determined upon by the Russian authorities, says *Ausland*. Peter the Great long ago busied himself with such a project, which only lately was revived by the Russian society for the promotion of commerce and industry. The cost, which is estimated at seven million rubles, will be borne by the state. Work will be begun upon the canal the present year.

— Statistics of the French sea-fisheries, for 1884, recently published, give the total value of the catch for that year at 87,961,124 francs, — a decrease from that of the previous year of 19,265,797 francs.

— Dr. Valentine Mott, who went to Paris some months ago to study Pasteur's methods of hydrophobia treatment, has just returned, very sanguine in his belief of its efficacy. He brought with him, on his return, a rabbit inoculated by Pasteur just before his departure. The rabbit died on the seventh day after receiving the virus, a short time before coming into port. This is said to be the first time that Pasteur has given the virus to any one, and it will be utilized for further propagation and hydrophobia treatment by Dr. Mott.

— One of the oldest medical colleges, if not the oldest, in the world, is the Medical school of the Imperial university of Japan, which now numbers its centuries by two figures. In its earlier period its faculty included a superintendent and assistant, one professor of medicine, one of acupuncture, one of massage, and various other instructors in special diseases, materia medica, botany, etc. The course then covered seven years, and even now the school shows a more creditable status than the most of ours. Four years in actual medical studies are now required, with three years' preparation, — in all, seven years of college training. We wonder whether the profession in

America would be crowded as badly as the universal lamentations of medical men indicate, if all were excluded from practice, save those who had spent seven years in preparation. The course of instruction at the Japanese college is modelled after that of the German schools, and the lectures are mostly delivered in the German language, by the five foreign professors, though there is a special course in the Japanese. The total number of students in attendance last year was nine hundred and seventy-two.

— Messrs. W. T. Jackman and J. D. Webster have lately succeeded in obtaining good photographs of the retina of the living human eye, illustrations of which are given in the English *Photographic news*. They were able to bring the time of exposure for the negative to within two minutes and a half, and it is very probable that technical skill will further reduce the time and difficulties. The chief obstacles to shortening the time of exposure, so far encountered, are the color of the retinal reflection, and the fact that the lens of the eye has the property of absorbing the ultra-violet rays. It seems highly probable that the photograph will here become a valuable adjunct to the physiologist, ophthalmologist, or even the general physician, as the eye affords diagnostic aid in not a few diseases.

— C. Wiegelt, O. Sacre, and L. Schwab have made a series of very valuable experiments, says the *Chemical news*, on the injury to fisheries and fish-culture by sewage and industrial waste waters. They find that chloride of lime, in proportions of 0.04 to 0.005 per cent chlorine, has an immediate deadly action upon tench, while trout and salmon perish in presence of 0.0008 per cent of chlorine. Sulphurous acid has the same action as chlorine, and is still more hurtful if another acid is simultaneously present; sulphites are harmless. Hydrochloric acid, 1 per cent, kills tench and trout. In sulphuric acid of 0.1 per cent, trout turn on their sides in two to six hours, while tench were not affected in eighteen hours. Acids are said to have less action, the higher are their molecular weights. Tannin at 0.1 per cent is' harmless. Ammonia exerts no action at 0.01 per cent. Soda at 1 per cent is fatal to trout on prolonged exposure. Manganese chloride at 5 per cent had no action on tench in twenty-two hours, and a trout sustained 1 per cent for five hours. Iron acts as a specific poison upon fishes, except in the state of a ferrous salt. Alum has the same injurious action as the salts of iron. Solution of caustic lime has an exceedingly violent action upon fishes, due in part to the deposition of calcium carbonate in the gills. Arsenious acid, 0.1 per cent, combined with soda, has no injurious action upon trout and tench. Mercuric chloride, in proportions of 0.1 and 0.05 per cent, is immediately fatal. Copper sulphate, 0.1 and 1.0 per cent, kills trout in a few minutes if they cannot escape into pure water. Potassium cyanide, 0.01 and 0.005 per cent, is rapidly fatal if there is no escape. Potassium sulphocyanide and ferrocyanide, in the proportion of 1 per cent, had no injurious action in an hour. Sodium sulphide, 0.1 per cent, was endured by tench for thirty minutes. The fish were bleached, and did not recover their color in pure water. Hydrogen sulphide proved rapidly fatal in the proportions of 0.01 and 0.001 per cent. The hurtfulness of putrid sewage depends on poisonous gases, on the deficiency of oxygen, and on the action of bacteria.

— The death is announced of Mr. Thomas Edwards, the Scotch shoemaker naturalist whom Dr. Smiles made famous.

— In an article on coal-consumption as affected by temperature and length of trains, the *Railroad gazette* reaches some interesting conclusions. Dead weight to the amount of thirty tons added to a train of, say, five cars, will not increase coal-consumption as much as to add another car, both because it does not increase air-resistance and because the added load decreases somewhat the rolling resistance per ton. If we assume it to add five pounds per mile to the coal-consumption, we are certainly not underestimating it proportionally. Adding six tons per car, therefore, to the average weight of a train of five passenger-cars, means no more than an increase from fifty-five to sixty pounds per train-mile. If we assume this five pounds of coal to be worth one cent (at the rate of four dollars per ton of two thousand pounds for coal), and if an extra passenger at three cents per mile be attracted to the train every third trip, he will pay for the loss of fuel due to adding six tons to the weight of every passenger-car, which goes a little way toward explaining the tendency to increase weight for the sake of luxury, which seems so reckless. In this estimate, the effect of extra weight on grade-resistance is taken into account, though in reality it is comparatively unimportant. It is estimated that about six pounds and a half of coal per mile are added to the consumption for each passenger-car of twenty tons or more moved at way-train speed, and for each sleeping-car of thirty tons or more moved in through trains making few stops, and that the locomotive alone is to be charged with rather more coal than that due to three cars.

— The discovery of an interesting illusory effect in the sense of sight is given by Professor Exner

in the *Biologisches centralblatt*. His attention was directed to the subject by a simple incident. Lying upon the floor of a hut near an open fire, he noticed that the sky, as seen through a small window, seemed frequently lit up, as though by lightning. Assuring himself that such was not the case, he found that the apparent phenomenon was due to a deception caused by the flickering light in the room, though no changes in its intensity were visible. To show the effect more strongly, he constructed a translucent shade before a lamp, upon which he attached a small disk of thick white paper. This lamp was so arranged that its brightness might be quickly and easily varied. On the other side a gas-lamp enclosed by an opaque cylinder was placed, emitting a ray of light through a lens directly upon the paper disk. Looking now at the disk through a hollow cylinder at a distance of several feet, while the light behind the shade was made to vary in intensity, there was found a striking effect, in that the variation appeared to rest only in the paper disk, while the surrounding field appeared constant. This illusion, the author says, shows that we are inclined to hold as constant the predominating brightness in the field of vision, and attribute variation to the subordinate.

— It has been experimentally proved by the English commission on accidents in mines, as stated in their last report, that a percentage of marsh-gas amounting to five per cent, or even four per cent, of atmospheric air, is decidedly explosive. Half of this proportion, however, though not in itself dangerous, and though impossible of detection by ordinary lamp-tests, will explode if the air be laden even lightly with fine, dry coal-dust; and it is probable that some of the obscure causes of accidents may be ascribed to this cause. The opinion of the commissioners with regard to the older Davy, Clauny, or even Stephenson lamps, is that they have in a great measure lost their value in consequence of the draughts of air from the free ventilation. A current of air of eight hundred feet per minute in an impure atmosphere may, in spite of the wire gauze, effect an explosion in any one of them. Electric lighting is already to some extent in use; and as the risk from its use is much less, and its lighting-power greater, it probably will be more generally adopted.

— The summary report of the operations of the geological and natural history survey of the Dominion of Canada by the director, A. R. C. Selwyn, gives a creditable showing for the amount of money expended. Work, chiefly geological and topographical, has been prosecuted over portions of every province and territory in the dominion, from Nova Scotia to the west coast of Vancouver Island. The *personnel* of the survey is now composed of a staff of fifty employees, — thirty-four professional, and sixteen ordinary. The expenditure amounted to something over ninety thousand dollars during the past year. The topographical results will be embodied in a number of maps now in process of preparation. These maps include one of British Columbia, that will shortly be published; one of Assiniboia, now in the hands of the engraver; and one of the Bow and Saskatchewan rivers, on a scale of eight miles to the inch, well advanced. Another on Manitoba and western Ontario, to cover 3,456 square miles, and a very important geological map of the peninsular portion of Ontario, to be issued in sheets of uniform size, are in progress, as well as maps of Quebec, the Lake of Mistassini and adjacent regions, and portions of Nova Scotia and New Brunswick. Much less attention is paid to biology, with the exception of paleontology; yet in botany and zoölogy considerable progress has been made. Among the more interesting results of the explorations is the determination of the size of Lake Mistassini, about which there has been great uncertainty. It was found to be about one hundred miles in length, with an average breadth of about twelve miles, — a very different figure from what is represented on the maps.

— Dr. Alfred Goldscheider, says the *Lancet*, has recently published the results of researches he has made upon the nerves, by which sensations of temperature and pressure are conducted. He finds that the skin is not in all parts capable of perceiving variation of temperature, and that some parts can only recognize sensations of cold, other parts only sensations of heat. These, which he terms warm and cold points, are distributed between or among each other, but never coincide. Their general arrangement is, that they are disposed in chains which pursue a slightly curved course. These chains radiate from certain points, which may be termed radiation-points or temperature-centres. The chains of the cold-points do not in general coincide with those of the heat-points, but these radiation-points are identical. The cold-points are in all parts of the skin more numerous than the warm-points. When the cold-points are excited by either mechanical or electrical stimuli, a punctiform sensation of cold is experienced, and the opposite sensation is felt when the warm-points are stimulated. Goldscheider was able, by stimulation of nerve-trunks, to excite eccentric sensations of heat and cold. The temperature-points were found to be insensitive

to pricks and other punctiform pain-excitants. Goldscheider admits, therefore, not only the existence of nerves exclusively devoted to perceptions of temperature, but specific nerves for heat and cold. The sensibility of the surface of the body to temperature presents great topical variations, and is directly dependent in any region upon the number and intensity of the temperature-points, — that is to say, upon the local wealth of temperature-nerves, — and go hand in hand with the distribution of the great nerve-trunks. Goldscheider also differentiates in the skin nerves of general sensation and specific pressure-nerves. The latter terminate in certain points of the skin which are not only especially sensitive to very delicate contact, but contain also peculiar organs which excite a granular sensation on pressure. The pressure-points are arranged after the same fashion as the temperature-points, but are in general much more closely aggregated. Both they and the temperature-points supply us with information in regard to locality.

— Any one may become a member of the Roman alphabet association, to which reference is made in the article in this number on 'The intellectual movement in Japan,' by the payment of an annual fee of one dollar. All donations should be addressed to Roma-ji-kai, Tokio, Japan.

— The dredging-machinery for the excavation of the Panama canal is exceedingly powerful. One of the dredges excavates 3,300 cubic metres per day, and there are two others which excavate 800 and 1,000 cubic metres. Besides these, there are a number of smaller ones in operation, in all, capable of excavating 37,000 cubic metres per day. It is reported that during the month of February, upwards of 1,100,000 cubic metres were excavated.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On a geodetic survey of the United States.

I HAVE been often asked why a geodetic survey and triangulation is the only mode of surveying a large area with precision, and why such slow and tedious methods are requisite for needful accuracy. This paper is an attempt to show, in popular language, both the processes themselves and their necessity: as also why congress should act upon the repeated recommendations of the national academy, and carry out its views.

To many of the habitual readers of *Science*, this letter will appear to deal with elementary matters which they may be assumed to know. To another large and equally earnest class of readers, it may convey useful information. Possibly it may help forward the end sought for; and to this every true lover of science will cry 'God speed.'

Any survey of a small area, as a farm, plantation, or township, may be made by any of the usual methods adopted in ordinary land-surveying, where the area covered by the survey is treated as a plane surface.

The compass and Gunter's chain of sixty-six feet are the usual surveying-instruments in this country. They are liable to serious error. Lack of knowledge of the true local magnetic variation of its secular change from year to year, and of its diurnal change between morning and afternoon, with the always impending possibilities of special local attraction at or near the place surveyed, are among the difficulties attending the use of the compass. The chain stretches with use, and changes its length with the seasons and their varying temperatures, and is often carelessly carried by men little accustomed to precise methods. It is not too much to say that any land worth fifty dollars an acre is too valuable to be surveyed with a compass, and any record of such a survey is likely to become a fruitful source of future litigation. The best of such surveys are but approximations to the truth.

Errors from these approximate measurements are cumulative. When such surveys are extended over large areas, as upon our public lands, serious consequences follow, involving present and future doubt and litigation as to boundaries. This is already apparent in the west. It will become more so in the future as land increases in value.

The necessity for greater precision in original public-land surveys, and for means of ascertaining and checking errors already existing, has been forcibly stated in a report to congress on the survey of the territories, by the National academy of sciences in November, 1878, printed in 'Misc. doc. No. 5, house of representatives, 45th congress, 3d session.' The report of the academy, and the very strong letter of Major J. W. Powell, which forms a part of it, fully describe the character and consequences of the errors alluded to. It also sets forth the true remedy as only to be found in a method of survey which should be as nearly infallible as scientific skill and a laborious and careful application of well-known principles could make it.

This method, as practised for two centuries by civilized nations, consists of a system of triangles, starting from and proceeding toward certain base-lines, measured with every possible care with apparatus specially devised to either entirely eliminate, or to reduce to a minimum, every source of error, whether physical or mechanical, which might vitiate the resulting length of the measured line, or cast a doubt upon its precision.

Apparatus of this nature is now constructed and used, in the U. S. coast and geodetic survey, of such precision that the average probable error of the two primary bases last measured with different apparatus, constructed on different principles, is, roughly, about one twelve-hundred-thousandth part of the lengths of the measured lines.

The exact length of the base being ascertained, and a system of triangles built upon it adapted to and covering the country to be surveyed, the lengths of all the other sides of the triangles in the system are inferred from the familiar theorem that "every triangle has six elements or functions, — viz., three sides and three angles, — any three of which being known (one being a side), the other unknown elements may be computed" with a degree of precision of the same order as that of the known elements.

It is therefore only necessary to measure the angles with the same precision as the base, to insure equally precise results. This is so far attainable, that the latest great primary triangulation of the coast and geodetic survey, enclosed between two measured bases six hundred miles apart, met nearly midway, at a line about twenty-nine miles and a half long. The computed lengths of the line, from measured bases distant about three hundred miles from either of them, agreed within about five-eighths of an inch.

It follows from the above, that, in any system of triangulation carefully conducted, the relation of every point in the system to every other point may be determined with a degree of precision almost absolute. It renders the position of each apex of a triangle infallible; since its error, if any, can only be detected by application of similar methods of precision, which will themselves be liable to the same sources of error.

Referring to what has been written as to cumulative errors belonging to all ordinary local topographical or other surveys, it is evident, that, if these surveys include two or more trigonometrical points within their limits, the inevitable error involved in their methods is checked and corrected as each such point is successively reached. If it is not exactly hit, the local survey is wrong, and must be corrected to meet the triangulation-point, which stands as infallible in its assigned position as the pope claims to be in his.

The triangulation gives the relation of every point in the system to every other point. To apply the data thus obtained to its chief use in the construction of accurate maps, from the local surveys thus checked and corrected, another class of observations and reductions becomes necessary to fit the framework which has been constructed to its proper place upon the surface of the earth. This, with the triangulation, constitutes what may properly be called geodesy. No better definition of this term can be given than that by the late Gen. R. D. Cutts: "Geodesy, in practice, may be described as a system of the most exact land-measurements, extended in the form of a triangulation over a large area; controlled, in its relation to the meridian, by astronomical azimuths; computed by formulae based on the dimensions of the [adopted] spheroid; and placed in its true position on the surface of the earth by astronomical latitudes and differences of longitude from an established meridian."

The whole system of triangulation thus combined and co-ordinated, and made to occupy its true position upon the earth's surface, may be compared to a human skeleton. As the skeleton is the framework on which is built and sustained the varied elements of the human body, each fitted to and held in its place by the unyielding structure sustaining it, so the triangulation is the framework on which each varied portion of the earth's surface within its range is also fitted to and held in its true position, and the resulting map becomes an absolutely true topographical picture of the country it purports to represent.

But this is only one, and not the greatest, good represented by a well-executed and complete geodetic survey. Every point of the triangulation is carefully marked above and beneath the surface for reference in future ages. Every recorded distance between any two points thus marked becomes a base-line, whose length is known with a degree of precision unattainable by ordinary methods. So, also, is the azimuth or angle with the true meridian made by every such line, thus affording means for ascertaining the local magnetic variation and its yearly change. The recorded and published latitude and longitude of any station will enable future astronomers to find close at hand the means of fixing their precise relations to other and distant observatories. As the country increases in population and wealth, its topographical features change. New towns are built, and new roads and new railroads laid out. New maps will be called for, and easily supplied, since the framework of the triangulation, executed half a century before, perhaps, is there, always correct and reliable. As the elevations of all the stations above the mean level of the sea have been determined in the original survey, so, if schemes of drainage are planned to bring swamp-lands into use for arable purposes, these differences of level will afford data for obtaining the amount of fall and its proper direction. And so long as the earth and sea maintain their relative positions, so long the beneficent effect of early and exact triangulation will continue to be felt.

This is essentially a national work. It cannot be defined by, or confined within, state boundaries. Whatever views may be held as to local topographical surveys, and who shall execute them, it is evident that the framework on which they are to be built must be independent of political boundaries. The triangle sides leap across bays and lakes, or from mountain to mountain and hill to hill, or they travel 'upon stilts' across the level swamps and prairies. Nature only fixes its limits. It is homogeneous and universal by its own conditions of existence. The geodetic survey of all our country is therefore a work eminently proper for the national government to carry on, leaving the other questions of local topographical surveys for national or state action, or for both combined, as in Massachusetts.

The National academy of sciences, which is, by law, the adviser of congress and the executive upon scientific matters, has twice, at the call of congress, advised the early execution of this great work, and that its execution should be intrusted to the coast and geodetic survey as best fitted, in men, means, and training, to carry it on. Lately the need of prompt action in the same direction has been well and strongly set forth by Prof. W. P. Trowbridge of Columbia college, whose large experience gives weight to his words.

If states whose interests require good maps will join with commercial bodies and scientific men in urging legislation, the plan proposed by the national academy in 1878, and again in 1884, may be carried out with no duplication of other work, but, on the contrary, with cordial and complete co-ordination with other surveys. The whole country would be benefited thereby to an amount far exceeding the outlay. C. O. Boutelle.

Washington, May 11.

Double vision.

Your correspondent, Dr. George Keller, will find the phenomena of double vision discussed in Helmholtz's 'Physiological optics,' and in LeConte's book on sight. The latter is a small volume published by D. Appleton & Co., New York. The production of binocular images, apparently suspended in mid-air, on regarding a tessellated pavement or papered wall

with visual lines appropriately crossed, is discussed but incorrectly explained by Sir David Brewster in his book on the stereoscope, many of his experiments having been performed more than forty years ago.

Dr. Keller seems to be affected slightly with divergent strabismus; which, however, has not resulted, as it so often does, in the loss of power to secure binocular vision. He will find the phenomena of vision by optic divergence discussed in a series of articles entitled 'Notes on physiological optics,' published in the *American journal of science* for November and December, 1881, March, April, May, October, and November, 1882.

W. LECONTE STEVENS.

170 Joralemon Street, Brooklyn, May 15.

Diathermancy of ebonite.

Absence from home has prevented me seeing sooner *Science* for April 30.

In referring to my paper read before the April meeting of the National academy of sciences, you state, "Prof. Alfred M. Mayer, in describing recent work, stated that he had succeeded, by the use of a lens of ebonite, in inflaming various substances by the concentration of dark rays, for which ebonite is translucent." The statement is not what I stated before the academy. The title of my paper, as published by the academy, is, "On the diathermancy of ebonite and obsidian, and on the production of calorescence by means of screens of ebonite and obsidian."

The focus of dark rays was obtained by 'screens' of ebonite and of obsidian placed across the cone of rays reflected from a large mirror, or those refracted by a lens of glass of twenty inches diameter. I have obtained foci of dark rays with a combination of thin lenses of ebonite, but the heat of such foci is not sufficient to inflame substances.

ALFRED M. MAYER.

Hoboken, N.J., May 13.

Pharyngeal respiratory movements of adult amphibia under water.

The letter of Profs. S. H. and S. P. Gage, in your issue of April 30, induces me to recall and publish an observation made by me in 1877.

During a stay of some months in New York in the summer of that year, I several times visited a museum and aquarium, situated, if I remember aright, on 6th Avenue. I saw there a very fine specimen of Cryptobranchus Alleghaniensis about twenty inches long. I watched from time to time for several hours, but never saw it rise to the surface for air. As it lay at the bottom of its clear glass tank, I saw very distinctly continuous rhythmical respiratory movements. These, however, were not confined to the pharyngeal region, but seemed to me to extend the whole length of the body-cavity. It was a kind of squirming or wriggling movement running down the body. I looked carefully for currents issuing from gill-slits, but could see none.

At that time I concluded that the movements served the purpose of churning up the air in the lungs so as to utilize as much of the oxygen as possible. This seemed the more necessary in amphibians on account of the simplicity of their lung-sac. I had fully intended to draw scientific attention to the subject, but on returning home I could not at once lay my hand on a good account of the gill apparatus of the adult Cryptobranchus, and meanwhile other things engaged and diverted my attention.

It might be well for those who are studying this subject to at least bear in mind the suggestion that rhythmic movements may possibly serve to utilize more perfectly the oxygen contained in the lungs of animals capable of remaining long under water. In my boyhood I have often waited, rifle in hand, three hours for an alligator to rise; and that, too, in mid-summer, when their vitality is highest.

JOSEPH LECONTE.

Berkeley, Cal., May 10.

Absorption of mercurial vapor by soils.

In the issue of *Science* for April 23, it is stated (p. 370) that the mercurial-vapor remedy has, in the hands of myself and assistant, failed to produce its promised results as a phylloxera insecticide.

This sweeping statement is not justified by the facts given by me in the issue of this journal for Dec. 4, 1885, and by its further elaboration as given in the 'Report on viticultural work,' since published. It has been demonstrated by our experiments that the reported total failures were due to improper materials used in the preparation of the mercurial mixtures, whereby the formation of mercurial vapor in the soil was practically prevented, and that when reasonably pure mercury is employed, and proper means used for its distribution in the soil, all insects within the mercurialized area died in the course of from thirty to forty-eight hours at the ordinary temperature, and much more rapidly at a higher one. It therefore appears perfectly practicable to protect vines planted in uninfested ground from attack coming from without, by surrounding the stocks with a sufficiently thick (eight to ten inch) layer of mercurialized soil, which, without obstructing or repelling the entering insects, will insure their being fatally poisoned before they can pass through it. This would leave the choice between grafting on resistant stocks on the one hand, and the mercurial protection on the other, in the planting of new vineyards, the cost being (in California) about the same in either case; it would also serve for protection against threatened invasion, in the case of vineyards already planted, since, apart from the case of open soil-cracks giving access to the vine-roots, the stocks are the only known route by which the phylloxera reaches the root. Such are the presumptions created by our small-scale experiments: how far the process will prove available in large-scale practice, remains to be determined by experience, but there is no especial reason to question its feasibility.

As regards, however, the treatment of ground and vines already infested, our experiments tend to show that the diffusion of the mercurial vapor is too slow, at the ordinary soil-temperatures, to promise success; especially in the case of clay soils, which absorb and render inert a large amount of mercurial vapor before an effective excess can be obtained.

It has been abundantly shown that the mercurialized soil exerts no unfavorable action upon the growth of the vine; and there is every reason to expect that an application once made will remain effective during the life of the vine.

E. W. HILGARD.

Berkeley, Cal., April 8.

SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 21, 1886.

THE AGRICULTURAL INDUSTRIES OF JAPAN.

It was not many years ago that Japan was looked upon as an uncivilized nation, and her remarkable development during the past two decades has been a subject of astonishment to the civilized world. It speaks well for the natural intelligence of her people that she has profited so well by the experiences of foreign civilization, and much can be expected in her future progress. Many conditions productive of evil in civilization have not yet found a place in her affairs, and in some respects the lower classes may be considered as occupying a higher plane than those of more favored European countries.

A recent paper[1] by Prof. M. Fesca, with the assistance of Mr. N. Tsuneto, presents one of the fullest accounts of the agricultural conditions and industries of this people that have so far appeared, from which we give an abstract of the more interesting portions.

Many important factors affecting the agriculture of Japan, as would naturally be supposed, have yet received comparatively little attention, although the results so far attained are surprising when we take into consideration the rapidity with which they have been produced. Especially is there need of a more scientific study of the climate and meteorological conditions. Most of the meteorological stations hitherto founded are along the seacoast, with but very few in the interior.

One of the chief hinderances to the development of Japanese agriculture has been the burdensome system of taxation, which is levied almost exclusively upon real estate, and which prevents the use of capital to any great extent. The high rate of interest, of which fifteen per cent is considered moderate, for money loaned upon real estate, almost prohibits its use. In those districts where agriculture has reached its chief development, it has been due almost wholly to unaided manual labor.

Agriculture can only reach its highest development when the producer owns the land, and especially when capital is unrestricted in its employment for its improvement or cultivation. Statistics, so far as they are available, however, show that lease systems, wherein compensation is derived either by division of crops or from money payments, predominate over independent tenures of land in Japan. In the dryer lands money-rent is usually paid, varying in amounts for the different crops raised. For rice-land the so-called 'half-crop' system is the more common one, though in reality a far larger proportion of the gross harvest returns is paid. Four-fifths of the crop go to the owner of the land; and, from the one-fifth remaining, all the costs of fertilizing and harvesting must be obtained, and which not seldom consume its substance. The remedy for these evils will only be found in the legal control of the lease systems, and more especially by a change in the system of taxation, which will relieve the land from the severe burdens now imposed upon it, and thus bring about more favorable systems of credit, admitting of the more extensive use of capital. At present the lessee of small farms derives only a very meagre income.

Another important factor which exerts a most depressing influence upon Japanese agriculture, is the difficulty and cost of transportation. The lack of water-ways, railways, and good roads in Japan is very sensibly felt. The pack-horse is the means upon which the chief reliance is placed for carrying; and upon the best roads the burden of three hundred and thirty pounds costs ten sen[1] per ri, while upon bad roads the cost may be quadrupled. This high cost of transportation influences in a very great degree the sale of farm produce. Rice commands the highest price among the grains, in Tokio the past year selling for one dollar per hundredweight. The cost of its transportation for twenty miles amounts to as much as its price. When this is compared with the cost of the transportation of wheat by railroads in America, some appreciation of the immense disadvantage under which Japan labors will be apparent. For this reason the regions of the coast are far more preferred for agriculture than the inland, every possible portion being utilized, while in the interior often large tracts of good land are left untilled.

Thus it will be seen that one of the chief demands of Japan is for better and cheaper means

[1] *Die landwirthschaftlichen verhältnisse der Kai-provinz in beziehung zu denen des japanischen reichs, Mittheilungen der agronomischen abtheilung der kaiserlich japanischen geologischen reichsanstalt*, April, 1886.

[1] 100 sen = 1 yen, about 86 cents; 1.9 ri = 1 geographical mile. The Japanese terms are mostly reduced to their English equivalents.

of transportation. Railroads, so far, have done little towards remedying the evil, and will not unless tariffs are sufficiently lessened to admit of more extended commerce. The distance between Tokio and Kofu is about sixty-four miles, one half of which is easily, the other with difficulty, passable. The cost of transportation by horses is nine yen per load (over two dollars per hundredweight). The following market-prices at Tokio, of a few of the more important productions, will show the extent to which the cost of transportation affects the price : —

	Per cwt.	Cost of transportation from Kofu.
Tobacco (medium quality)	$15.50	15.5%
Cotton (medium quality)	13.00	10.0%
Cotton (raw)	5.20	25.8%
Silk-worm cocoons	66.00	1.9%
Silk-stuffs	833.00	0.5%

The great cost of transportation of raw or bulky articles has caused certain industries, as silk culture and weaving, where the manufactured material is of light weight and easily transportable, to be extensively prosecuted in the interior, especially by the women, and such industries are thus properly classed as agricultural.

Japanese statistics of agricultural productions are necessarily imperfect, but they are sufficient to afford a tolerably good idea of the resources of the kingdom, or at least of some portions of it. The area of the entire kingdom, as at present constituted, comprises 24,294 square ri (87,701 square miles), or 11,054,019 cho (27,082,346 acres). The following table will show the proportions of tilled, tillable, and other lands, together with the prices for the same : —

	Acres.	Per cent of entire land.	Average price per acre.
Rice-land	6,605,627	23.80	$194.00
Other tilled land	4,631,187	16.80	57.30
Forest-land	13,601,427	49.85	1.36
Tillable (uncultivated land)	1,890,150	6.85	1.00
Building-ground (villages and cities)	871,350	—	500.00
Salt-yards	15,910	—	120.00

The unoccupied tillable lands are covered with scant vegetation, which serves for pasturage for stock, though little used : doubtless the figures given are too small, and should be increased at the expense of those for forest-land. The salt fields or yards (*salzgärten*) are the only sources of salt in Japan, and are for the evaporation of sea-water. Rock-salt and salt-wells have not, so far, been discovered in the kingdom. Salt, it may be mentioned, furnishes a good example of the variation in the cost of transportation, as in some parts it commands nearly thirty times what it does in others. The rice-land, it will be seen, comprises nearly one-fourth of the entire superficial area, and commands more than three times the price of other tilled land.

The price of really valuable land can in no wise be considered as low, as compared with that of the agricultural lands in Germany. The price of rice-land is at least one-half greater, and, of the other grain-lands, about half as great.

The number of those engaged in agricultural industries throughout the kingdom, from the returns that are available, is as follows : males, 8,237,682 ; females, 7,398,431 ; total, 15,636,113. The entire population of the kingdom was nearly thirty-seven million ; and for such a distinctively agricultural nation as Japan, the proportion devoted to agriculture appears small. This disproportion may in part be attributed to the great number of officials, and petty shops and pedlers, — occupations which draw from the lower classes, by reason of the less labor required, and the comparatively less onerous taxation imposed upon them, than is the case in the agricultural pursuits ; and in part to the fact that those partially engaged in other pursuits are often not counted as agriculturalists. There are only about three-fifths of an acre of tilled land to each individual in the entire population, or less than three acres to the average family.

It will not be without interest to make some mention of the foods used by the people. The Japanese are almost exclusively vegetarians, — a fact that is to be deplored, from the detrimental influence it has upon the raising of live-stock. On the coast, fish and other sea-foods are used in considerable quantities ; but at a distance, from the ever-recurring element of transportation cost, these foods form only an immaterial proportion of the alimentation. Rice is the chief comestible, except in such higher regions where it cannot be raised, and where the cost of importation virtually prohibits its use. The percentages of the different foods consumed are as follows : —

Rice	[illegible]8.00
Barley and wheat	27.00
Millet and other grain	18 90
Sweet-potatoes and garden-vegetables	6 00
Fruit	0.05
Algae	0.05

Farm-laborers are paid throughout the kingdom, on an average, in summer, 18 cents per day for the best men, and 13.3 for the best women ; for a poorer class of men the compensation is

12.5 cents, and of women 8 cents: in winter they are paid 14.5 and 9.1, and 9.8 and 5.5 cents respectively. This is in addition to board. The highest price paid in any province is, in summer, 27 cents for men, and 20 cents for women. The average price per year is $30.50; the maximum, $74; the minimum, $13.70; in Tokio, $31.40. Taking all things into consideration, in comparison with the sums paid for similar labor in Germany, farm-labor is decidedly dearer in Japan.

These high wages may be taken as an expression of a more uniform distribution of property than obtains in the European countries, and speak in favor, rather than against, the social conditions of the kingdom. There does not prevail that sharp contrast between luxurious wealth and hungering misery; and as a result, class hatreds, with all their attendant evils, are foreign to Japan. Wages, however, are much higher at present than they were even a few years ago. In some provinces during the last twenty years they have increased seven or eight fold.

It will be of interest to give the actual production of the staple products of the kingdom for 1882, as nearly as can be obtained from statistics.

	Entire production.	Per acre.
Rice (meadow and upland)	162,269,090 bush.	25.25 bush.
Barley	53,983,050 "	22.50 "
Wheat	12,782,380 "	14.1 "
Beans	11,927,819 "	11.9 "
Millet	14,961,874 "	—
Sorghum	367,784 "	—
Buckwheat	8,458,639 "	9.5 "
Potatoes	74,117,611 lbs.	3,700.00 lbs.
Sweet-potatoes	2,150,975,318 "	6,250 00 "

It is necessary to observe, in explanation of these figures (a calculation of which will show an apparently greater number of acres than are actually under cultivation), that in many cases two or even more crops are obtained annually from the same field.

The entire value of these crops reached, according to the statistics of 1882, the sum of 158,884,113 yen ($123,462,655). This gives a gross sum of $12.44 per acre, and less than $8 for each individual engaged in agricultural pursuits. In comparing these figures with those of the averages of the eight older Prussian provinces, between the years 1859 and 1864 they are found to be more than one-third less. The net results, however, of the returns, per capita, are considerably less; scarcely, in favorable cases, reaching $3.50. They do not, however, indicate the true condition of affairs. A laboring man requires for annual consumption, about five bushels of rice, and the average for man and woman may be placed at four bushels. As the cost of this quantity is over four dollars (4.5 yen per koku = 1.8 hectolitres), the people would be reduced to a much cheaper way of living, which is not the case. The exports and imports are comparatively trivial, and will nearly balance each other.

More than one-eighth of all the rice grown is consumed in the production of *sake*, the alcoholic drink universally used in Japan, leaving, on an average, about 3.5 bushels as the annual amount per capita. Adding to rice other productions, it is found that 5.7 bushels of grain represent the quantity annually consumed by each individual of the population, to which should also be added about 60 pounds of potatoes.

During the twelve years between 1868 and 1879 the entire export of rice amounted to a little over seven million bushels, with the imports a little more than twice that quantity. Of the other produce, figures cannot be given. It will thus be seen that the annual production of food-stuffs suffices for the entire population, although it is true the quota is by no means equally distributed throughout the population. The better-situated half takes the lion's share, to the deprivation of the lower class.

Statistics of the cultivation of rice sufficiently trustworthy to entitle them to our acceptance, reach back for nearly a thousand years, and show that there has been a steady decrease in the yield per acre. Thus in the period between 923 and 930 the area devoted to its culture amounted to 2,558,390 acres, with a yield of 95,924,326 bushels; while in 1868, with an area of 6,559,192 acres, the yield was only 157,153,500 bushels. Thus, while the entire area devoted to the crop has doubled, the crop itself has only increased about one-half. Undoubtedly a part of this is due to the added lands being less adapted to rice-cultivation.

The agriculture of Japan has progressed in its peculiar way without reference to stock-raising. For a very long period religious prejudices have not favored the use of flesh as a food, although it has not been strictly forbidden. There has been no demand for this food, and domestic animals were looked upon only as beasts of burden and sources of fertilizing-material. This exclusion of stock-raising has markedly influenced the extension of strictly agricultural industries. In the vicinity of the coasts the smallest portions of suitable land are cultivated, while at a distance the extent of untilled land becomes much greater. In thickly populated regions fertilizing-material, especially that from human sources, — the chief ones in Japan, — exists in much greater abundance, as also such material as fish-guano, seaweed, etc., furnished by the sea; but these cannot be made use of at any distance from the coast, for, under

the existing unfavorable conditions, they do not admit of being transported. In the regions remote from the coast and the more thickly settled districts, various substances, such as wood-ashes, the residue from grapes, cottonseed, beans, etc., are used for fertilizing-material; but the extent to which they can be employed is very limited, and for this reason some better source of compost-material is highly desirable for the further development of inland agriculture. The necessity of the introduction of stock-raising has been recognized in Japan, although its true value has hitherto not been rightly appreciated.

About eighteen years ago, Japan suddenly exchanged its mediaeval condition for one very different; and this must be taken into consideration in judging of the present state of affairs in that country, since, under such circumstances, one cannot wonder that errors have been committed, but, rather, that the results already reached have been so remarkable. Already a network of telegraph-wires covers the entire land, and railroads are increasing from year to year; and in the laws of the country undoubted improvements have been brought about. In the civilized countries of Europe the development of the modern condition from the mediaeval one was gradual; but in Japan this development has been not only more rapid, but also in many respects peculiar. Not only has it made use of many counsellors and teachers from other countries, but it has sent out a very considerable number of its own students to other lands, who have brought back many of the modern inventions and discoveries of civilized life. Such a process of development has been in many respects of great advantage to Japan, although not wholly without its elements of danger. They can avail themselves of the multitudinous results of civilization which have been slowly and laboriously acquired in European states in the many centuries, and at the same time avoid the many errors taught by painful experience, though it must be borne in mind that the old mediaeval conditions are not yet entirely done away with.

These conditions must be taken into account in treating of the development of live-stock industries in Japan. In the civilized nations of Europe, it is well known, that, until recently, live-stock was looked upon as a necessary evil, useful only as machines for the production of fertilizing-material. Circumstances were deemed fortunate when the income derived from the stock was sufficient to pay expenses, and thus furnish manure free of cost. In England scarcely a hundred years have elapsed since stock-raising has attained an independent position as a profitable industry, and in Germany its importance was not appreciated till a much later period. While in many other agricultural and technical matters Japan's progress has been more rapid than was the case in Europe, the difficulties which stock-raising encounter are greater, rather than less, than were the European ones in past centuries.

In the live-stock industries of Japan the horse and the ox are the only animals which have attained any degree of importance. Sheep do not thrive in the moist climate, and attempts have shown the uselessness of endeavoring to introduce this branch of stock-raising. But little attention is paid to hog-raising, although circumstances would seem to indicate its profitableness, and the opportuneness of its inception on a more extended scale.

The number of cattle in Japan is not only absolutely, but also relatively in proportion to the population, very small. In 1879 there were but 4.1 horses and 2.9 oxen or cows to every hundred inhabitants, — a number, for the latter, remarkably small. In the same year there was less than one head of cattle slaughtered for every thousand inhabitants for food, the consumption varying in the different provinces from five and a half per thousand to less than one per hundred thousand. Even in the large province of Musashi, in which the large flesh-consuming cities of Tokio and Yokohama lie, the consumption amounted to only 3.1 per thousand inhabitants.

It has been often asserted that the consumption of flesh in Japan is steadily increasing. Of the 1,075,520 head of cattle in Japan in 1877, 33,959 were slaughtered; in 1882 there were 1,159,750, of which 36,288 were slaughtered, — in both cases bearing the same percentage, 3.1, to the entire number. This percentage is very small, and it is seen that a large proportion of the stock must live to be very old, and die natural deaths.

Milk and butter, as will be understood, are unsalable in the interior, and non-transportable, and cheese and condensed-milk manufacturing requires more capital than is disposable in Japan. Further, the entire population has for butter and cheese a decided dislike, which is not wholly overcome even by those who have become accustomed to European diet.

Attempts have been made to improve the industry by the importation of foreign cattle; but this has been done without a proper study of the adaptability of different breeds to the peculiar climate and mountainous topography of the country, and the result has not been wholly satisfactory. Instead of introducing stock from the highlands of Scotland, Wales, or, better, from the mountain valleys of South Germany and Switzerland, Shorthorn, Devon, and Hereford stock has been im-

ported. There were imported, largely from America, in 1877, 498 head; in 1882, 1,430. Another obstacle which stock-raising must encounter is the difficulty in the way of pasturage. The scant herbage is unfitted for blooded stock, and the raising of grasses or grain will be unprofitable. In the inland regions the farmers of small means often keep a horse or a cow, not for work, but solely for the manure derived from it. It shows strikingly the lack of capital everywhere so prevalent. When a farmer finds an ox or a cow too costly, he buys a superannuated or broken-down pack-horse that can hardly stand, feeds it, and carefully collects the manure.

Notwithstanding all the obstacles, the importation and improvement of cattle in Japan, the author believes, should certainly not be abandoned. By a proper study of natural conditions, stock-raising may do much toward bettering the circumstances of the Japanese people.

A BOOK-MANUFACTORY IN ANCIENT ROME.

IN the *Illustrirtes schweizerisches unterhaltungsblatt für stenographen*, the *Publishers' weekly* finds an interesting account of the production of books in ancient Rome. It is stated therein, that, notwithstanding the Romans had no printing-presses, books were at that time produced much more quickly and in larger numbers than most modern works. Paper was used which was almost woven out of the fibre of the Egyptian papyrus, which grows to a height of ten feet, and which has given its name to paper. A Roman residing in Egypt assures us that the yield of his paper-manufactory would be sufficient to support an army, and whole shiploads of paper were sent from Egypt to Rome. Before books of any description were reproduced in large numbers, they were read mostly either in private circles or publicly, so that the author could adopt suggestions for the improvement of his work. Wealthy Romans used to own a large number of slaves for all kinds of services, which rendered labor cheap, as they cost nothing in many cases, and had only to be supported. They were mostly prisoners of war, the pick of nations, and often more cultivated (especially the Greeks) than their masters. They were consequently also employed in the education of Roman boys. The works of authors were dictated to a number of slaves, women also being employed for that purpose. Even among freemen and liberated slaves the desire to obtain employment became so great, that hundreds of willing hands could be had for writing books at a very low rate of wages. The instruction imparted in the work-shops of Roman publishers necessitated a regular course of training, which was to teach the apprentices an easy and elegant handwriting. If a publisher had at his disposal, say, a hundred writers, and reckoning the working-day at ten hours, a document which took an hour to write would be multiplied in the course of a day to a thousand copies. The writers became in time expert to such a degree that they combined quickness with elegance. It must also be added that in cases where speed was the first consideration, the use of stenographic contractions became general, and we possess illustrations of their employment in the old manuscripts still in existence. We are also informed that both readers and copyists were instructed and trained, the former in the solution, the latter in the application, of contractions. Their object was to copy works as quickly as possible, the use of full words being only resorted to for the best works. The above brief account demonstrates the fact that the Romans made the nearest approach to the invention of printing, although they never attained to it. The movable stamps of iron or other metals used by the Romans for marking earthenware vessels or other utensils also prove this. But the art of rapid writing, which was perfected by them to an unusual degree, counteracted a further development, while the number of slaves and other willing hands at disposal, by which means the most astonishing results were obtained, operated in the same direction.

THE HEATING-POWER OF GAS.

THE introduction of the gas-engine and the increased use of ordinary illuminating-gas for domestic heating-purposes, renders its calorific properties of far more importance than they were a few years ago, says *Engineering*. The experiments made on this subject do not appear to have been very exhaustive, and, if we may judge by those we are about to quote, have not always been carried out with due care. M. Aimé Witz, whose researches in connection with the gas-engine are well known, has lately made some experiments in order to determine with greater accuracy the heating-power in ordinary French illuminating-gas. His apparatus was composed of an explosion-cylinder of nickel-plated steel 2.36 inches internal diameter and 3.54 inches high. The thickness of the metal was .079 of an inch. The top and bottom covers were tightly screwed on, rendering the chamber air-tight. Through the top cover a wire passed, and on the bottom was a valve for filling or emptying the receptacle. This cylinder was contained in a vessel 4 inches in diameter and

8 inches high. This acted as a calorimeter, the amount of water required to charge it being 1.76 pints. In order to charge the explosion-cylinder, it is first filled with mercury, which is allowed to run out, the explosive mixture of air and gas taking its place. The explosion was caused by an electric current passing through the wire in the top cover. The result of a large number of experiments led to the conclusion that the average calorific power of well-purified illuminating-gas, as generally stipulated for by the concessions of French gas companies, is about 5,200 calories per cubic metre. This is equal to 584 British units per cubic foot. The standard of 6,000 calories, hitherto generally accepted, would therefore be too high. M. Witz's experiments more nearly accord with those recently made by Mr. Dugald Clerk, who estimated 504,888 and 489,268 foot-pounds per cubic foot as the mechanical equivalents of Manchester and London gas. This would correspond to 5,640 and 5,372 calories per cubic metre. M. Witz found that the calorific power of gas supplied from the same works varied considerably, at different seasons of the year ranging between 4,719 and 5,425 calories; but the average of tests showed that the difference between the gas supplied by various works was not great. The purification of the gas reduces the calorific power by more than 5 per cent. The gas produced during the last hour of a charge is inferior in heating-power to that obtained during the first hour. The heating-power of gas may be increased 77 per cent by carburation; but the gasoline employed becomes rapidly less volatile, and, when reduced to one-fourth its volume, its enriching-power is only 34 per cent. The details of the experiments, which appear to have been made with every precaution to insure accuracy, have been given in the *Annales de chimie et de physique* for 1885, and are quoted in the abstracts of foreign papers of the Institution of civil engineers.

REMSEN'S INTRODUCTION TO THE STUDY OF CHEMISTRY.

THE difficulty encountered by those who desire to have science which is true science taught in the high schools and academies of this country has been the lack of good teachers and of suitable books. Gradually, however, the books are appearing. Such volumes as those of Gray on botany, Guyot on physical geography, Dana on elementary geology, Martin on physiology, and others which we might name, are excellent examples of the skill with which men of acknowledged distinction as scientific men have prepared text-books adapted to youth in their teens. The influence of such books is to awaken a love of the observation of nature, and to show the scholar how, from simple phenomena, he may proceed to those which are difficult and complex. The improved condition of American school-books is sure to have a lasting effect upon the future citizens of this country. Already the increasing love of scientific studies and pursuits is manifested in a hundred ways.

Introduction to the study of chemistry. By IRA REMSEN. New York, *Holt*, 1886. 12°.

Professor Remsen has now prepared a chemistry which is intended for those who are beginning the study. No one will question his learning or his experience. For many years his daily round of the laboratory has made him familiar with the perplexities and difficulties which are encountered by students of every grade, — the bright and the dull, the immature and the adult. It sounds paradoxical to hear him declare at the beginning of his work, that, in face of the serious difficulties which lie in the way of a purely scientific treatment of chemistry, he thinks it possible to treat the subject more scientifically than is customary, and thus to make it easier of comprehension.

He therefore lays down as his guiding principle a desire to develop a scientific habit of thought; and this cannot be accomplished either by haphazard, and disconnected experimenting, or by considering the profoundest theories before the student is fitted to comprehend them. The proper course is to begin with an orderly sequence of laboratory lessons, to be performed, if possible, by every pupil for himself, and, if this is not possible, then by the teacher in the presence of a very small class, — not more than ten or a dozen persons.

This volume is therefore prepared as a manual for the laboratory of beginners. The cost of the requisite apparatus is not large, and is quite within the allowances of all superior schools, either for girls or boys. The beginning of the course is very easy; but it soon grows harder, and requires for its conduct a teacher who has himself been trained in laboratory methods. The self-taught chemist will be a very awkward guide. Such an instructor will find his work made delightful by the orderly, progressive steps which are marked out for the class to follow. At frequent intervals questions are interposed which the student himself must answer from his own observation and reading. Enough information is given to make his investigations easy and profitable, not enough to stifle independent thought. The author's doctrine is that a badly performed experiment is as objectionable as a bad recitation or a badly written exercise.

By the use of methods like these, chemistry is likely to hold its proper place in an educational curriculum. It should not be play, — a mere mode of whiling away the time in a series of entertaining surprises; and it should not be drudgery, — the attempt to master a series of names and formulas; but the science should be presented to the beginner as it appears to the advanced investigator, as the orderly, prolonged, well-guided study of certain classes of phenomena, in order that the laws which govern them may be discovered and applied.

In the opinion of the writer, which is based upon many years of observation of the study of chemistry as a part of a general education, the volume before us is admirably adapted to the purpose in view. Chemistry thus studied will be found an admirable discipline; and, if the scholar goes no further than to master the pages of this little volume, he will carry with him through life a clear conception of the methods of scientific study, and will thus be saved from many of the perplexities which have beset many scholars whose training has been exclusively based upon books, and who may, unfortunately for themselves and unfortunately often for the world, have been filled with horror at the progress of science. A single year of laboratory work will do more than the mastery of a cyclopaedia to assure the scholar of the truth of modern investigations.

COMPAYRE'S HISTORY OF PEDAGOGY.

To many persons the endeavor to treat teaching and the practice of education generally in a scientific manner seems nonsense. They liken teachers to poets, who must be born, not made, and fall back upon mother wit and natural instinct as the sole requisites for a good teacher. But teaching is not a new occupation: our principals and primary teachers are not the first to impart instruction to children. In fact, teaching is as old as civilization; and it would be strange indeed, if, in all these centuries, no experience that is worth any thing to us had been acquired. Education has been carried on under almost every possible variation of conditions, whether they be geographical, political, social, religious, ethical, or only personal. Human nature has an infinite number of phases, but its essentials vary but little from era to era. Therefore it would be more than strange, it would be miraculous, if the problems that confront our educators to-day had not been more or less dimly perceived and more or less successfully met in the past. Unless a teacher proposes to begin all over again, and try to repeat in his own experience the experience of the race, unless he proposes to test all possible methods, and fall into all the old errors, he certainly ought to be acquainted with the history of his profession. This is placing the desirability of a training in pedagogics on the lowest ground, — that of mere utility. It leaves out of consideration all that great philosophers have said and done concerning education; it takes no account of the relations existing between pedagogics on the one hand, and psychology, ethics, and politics on the other.

The history of pedagogy. By GABRIEL COMPAYRÉ. Tr. by W. H. Payne, A.M. Boston, *Heath*, 1886. 12°.

For the purpose of giving a general knowledge of past educational theories and practices, we know of no book so useful as the 'Histoire de la pédagogie' of M. Compayré, which Professor Payne has so opportunely translated. Grassberger's volumes are essential to a detailed knowledge of education in Greece and Rome. Schwarz and Niemeyer are excellent so far as they go, Von Raumer is minute on the great German educators, Schmidt's four volumes are classic, and Kloepper's little compend is an excellent manual; but Compayré's book, while not too special and technical to be uninteresting to the general reader, is full enough for the average teacher. We have only one serious fault to find with it, — it is written by a Frenchman. As a consequence of this, the writings of French educators are unduly prominent, and the course of the history of pedagogy is conditioned more or less by the history of France. This is, of course, a patriotic view, but a one-sided one. Since the Renaissance, educational progress has been international; and, if any one nation is to have the place of honor, that nation must be Germany. It is in Germany that the tenets of humanism, realism, philanthropinism and naturalism were most thoroughly developed and put into practice. Sturm was a German; Comenius, Ratich, Lessing, Pestalozzi, Fichte, Herbart, Beneke, Froebel, — to pick names at random, — were all Germans; and Germany, not France (despite the unsurpassed influence of Rousseau), should be most prominent in the history of pedagogy.

Apart from this faulty stand-point, there is little in M. Compayré's history to criticise. It is too brief, perhaps, in its treatment of the great schools of the middle age, but it is correspondingly full on Rousseau. We should be glad to have seen more on the great universities, especially those in Italy and Paris. Rollin, whom the German pedagogues are apt to overlook, receives his proper recognition here. The chapters on the education of women are among the most interesting in the book, and are, if we mistake not,

something of an innovation in works of this kind. Professor Payne's analyses of the various chapters are concise and clear, though his criticisms of Herbert Spencer's essay on education seem to leave out of sight the great influence for good that it has worked. The excellent index adds much to the practical value of the book.

Taken altogether, it is a valuable manual, and may safely be recommended to teachers and reading-circles. And for the use of the general public who are not teachers, we know no book at once so complete, and so free from technicalities.

THE STAR-GUIDE.

THIS is described in the preface as an introduction to Webb's 'Celestial objects for common telescopes,' though we should be more inclined to call it a conveniently arranged abstract of that well-known work. The compilers have tabulated in some twenty-four pages, six hundred celestial objects arranged in order of right ascension, comprising nearly every thing that can profitably be examined in our latitude with an instrument of two or three inches aperture (planets are not included). The right ascension and declination of each object is given for Jan. 1, 1886, and the mean time of passing the Greenwich meridian for every tenth day throughout the year. The introduction explains how to make allowance for a different longitude and for the change of the stars' positions by precession. Distances, position angles, magnitudes, and colors are given for double stars, and many interesting notes on the various other objects catalogued. Following this list for very small telescopes are about two hundred objects which can be seen with refractors of from four to seven inches aperture.

Perhaps the most useful part of the book is the list of two hundred and fifty test objects, divided into eight groups suitable for testing the performance of refractors varying from two to seven inches in aperture. Each of these groups contains three classes; viz., 'dividing tests, defining tests, and space penetrating tests,' — all most conveniently arranged. Several pages serve as a guide for lunar excursions, and a small table gives the positions of a dozen meteor radiants: an appendix contains information on variable stars and on the comets of 1886.

We think the book will be found useful by amateurs, and it is not to be entirely despised by the professional astronomer who is often called upon to act as celestial showman. If a chart of the moon and a small star-map (even no larger than that in Engelmann's translation of Newcomb's astronomy) had been added, it would save the trouble of frequent reference to other volumes. The price of the 'Star-guide,' we understand, is five shillings.

The star-guide: a list of the most remarkable celestial objects visible with small telescopes, with their positions for every tenth day in the year and other astronomical information. By LATIMER CLARK and HERBERT SADLER. London, *Macmillan*, 1886. 8°.

THE opening of the Euphrates valley between the Mediterranean and the Persian Gulf is one of the questions of the day, and may be regarded as complementary to the Suez Canal. If, as M. Dumont has recently pointed out to the French academy of sciences, the 1,400 kilometres which separate the Gulf of Alexandria and the Bay of Antioch from the Persian Gulf were traversed by a railway, six days would be gained in the voyage from Marseilles, Brindisi, or Salonica, to Bombay, and the hot passage of the Red Sea would be avoided. Many travellers, and also some of the more precious freight, would go by the railway. The tonnage of the Suez Canal will soon attain to 8,000,000 or 9,000,000 tons per annum; and 200,000 passengers may be expected to traverse it in the same time. Allowing that only a quarter of the passengers and one-twentieth of the tonnage goes by the new railway, M. Dumont remarks that this proportion would justifiy the making of the new line. The local traffic would also be considerable between Bagdad and the Gulf and other places. The nature of the ground presents no great engineering difficulties. The line would rise from the mouth of the Orontes near the ancient port of Salcuces, ascend the Alep to a height of four hundred and eighty metres, and descend towards the Gulf by way of Bagdad. M. Dumont estimates the total expense of construction at 250,000,000 francs. The scheme of M. Dumont is very interesting, especially after the report of Colonel Chesney to the English government; and the railway would doubtless be attended by the opening-up of the plains of Mesopotamia, which, by irrigation and cultivation, might be made to recover their ancient fertility. Some 2,000,000 acres of land would thus be recovered to civilization.

— *The housekeeper*, Minneapolis, Minn., was burned out for the second time in six years, April 12, and a part of its large subscription list destroyed, several of the ladies employed barely escaping with their lives. Such of our readers as do not receive the May number promptly, should write to the publishers, giving full address, time when subscription was made, and length of time paid for. The May number will then be fowarded, and the name restored to the list.

// SCIENCE.

FRIDAY, MAY 28, 1886.

COMMENT AND CRITICISM.

THE ELECTION OF A PRESIDENT of a college or university, especially in the case of one so venerable and distinguished as Yale, is an event of great importance. Under the present constitution of our colleges, — and it is by no means so faulty as some persons declare it to be, — the presidents not only govern, but they represent their institutions. The president's voice is generally the controlling influence in matters of academic policy and discipline, in financial matters, and in the selection of professors and subordinate officers : therefore his importance and sphere of activity are not limited to his own college, but are co-extensive with the wide boundaries of higher education. This fact has entered, though perhaps unconsciously, into the popular interest which has been manifested as to the choice of the Yale corporation for the succession to President Porter. Undoubtedly the activity of the younger alumni of Yale has served to keep the matter prominently before the public, but we know that in the university world, at all events, considerations higher than merely personal ones have been taken into account.

On Thursday of last week the matter was settled by the election of Rev. Timothy Dwight, professor of sacred literature in the Yale theological school, to the presidency of Yale college. Professor Dwight's election cannot be called unexpected, for the well-informed had some months ago settled upon him as the coming man. But there are elements in the choice which make it a peculiarly happy one. In the first place, no college, however progressive, can afford to break entirely with its past, to which, after all, it owes its present. The fact that Professor Dwight graduated from Yale in 1849, and has for more than thirty years been connected with the college as tutor and professor, identifies him sufficiently with the traditional policy of Yale to insure that it will not be inconsiderately abandoned. Then there are elements in the newly chosen president's personal views and opinions which promise that Yale will not be left behind in the race of development. He has carefully considered the details of university policy and organization, and we may be sure that he will guide Yale on the forward path as rapidly as the college can travel — but no more rapidly. That is the great point : Yale must grow and develop, but she must not lose her character in the process. Educated men throughout the country look to President Dwight to secure this happy mean.

No. 173.—1886.

IMITATION BUTTER.

THE manufacture of substitutes for butter originated with the production of the so-called oleomargarine, by the French chemist Mége-Mouriez, from beef-tallow. During the siege of Paris by the Germans, the making of this artificial butter was carried on upon a considerable scale, and was first brought prominently into notice. The manufacture of oleomargarine commercially, however, did not cease with the necessity which gave birth to it, but with various modifications has increased in amount, until now it is believed to have seriously damaged the dairy interests of the country ; and congress is being urged to pass a bill, which, under the guise of a revenue law, is really a prohibition law. The agitation has attracted such general attention, both from dairymen and from consumers of butter, and so much misrepresentation and flaming rhetoric have been called forth, that it may be worth while to consider calmly what are the facts in the case.

Process of manufacture. — Although numerous patents have been taken out for the manufacture of imitation butter, and a great variety of materials have been named in the specifications, the process as now conducted is comparatively simple. The raw materials are beef-tallow, leaf-lard, and the best quality of butter, together with small amounts of milk or cream and of butter-color.

From the beef-tallow is prepared the oleomargarine oil of Mége. The caul fat of freshly killed beeves is, after thorough washing, first in tepid and then in iced water, allowed to hang in a cold room until thoroughly cold. It is then rendered at a temperature between 180° and 175° F. The resulting oil is allowed to cool slowly until a considerable portion of the stearine and palmitine have crystallized out, and the pasty mass is then subjected to hydraulic pressure. The still fluid portion (about two-thirds of the whole) flows

out into a tank of cold water, where it solidifies into a granular mass which is known in the trade as 'oleo-oil,' or simply 'oleo.' The name 'oil' is somewhat misleading, as the product is a granular solid of a slightly yellow color. Fresh leaf-lard, treated in substantially the same way as the beef-tallow, yields the 'neutral lard,' or 'neutral,' of the trade, also a granular solid of a white color.

The objects of this treatment are twofold, — first, to produce fats as free as possible from taste or odor; second, to remove some of the difficultly fusible stearine and palmitine in order that the finished product may melt readily in the mouth.

Having thus secured the fats in proper condition, the manufacturer proceeds to mix the 'oleo' and 'neutral,' — the proportions varying according to the destination of the product; a warm climate calling for more 'oleo,' a cold one for more 'neutral,'— and to flavor the mixture with butter. This flavoring is conducted in large, steam-jacketed vessels provided with revolving paddles, by which their contents can be thoroughly agitated. Here the 'oleo' and 'neutral' are melted, and thoroughly agitated with a certain proportion of milk, or sometimes of cream, and a proper amount of butter-color. Forty-eight gallons of milk per two thousand pounds of product are stated to be a common proportion. After sufficient agitation, the melted mass is run into cold water, and as it cools is broken up by paddles so as to granulate the mass. After thorough washing, it is salted and worked exactly like butter. The product is known as oleomargarine. Although it contains hardly more than a trace of butter-fat, the latter flavors the whole mass so strongly that when well salted, as it usually is, it might readily pass with an inexpert or careless consumer for a rather flavorless butter. Oleomargarine is the cheapest product made. By adding to the material in the agitator, or 'churn,' more or less pure butter, what is known as butterine is produced, two grades of which are commonly sold; viz., 'creamery butterine,' containing more, and 'dairy butterine,' containing less butter.

Healthfulness. — Very exaggerated and absurd statements have been made, especially by the dairymen and their organs, regarding the unhealthfulness of butterine and oleomargarine. The charges have in general been, that the fat used is practically uncooked, and that raw animal fat is unwholesome; that filthy fat, and fat from diseased animals, are used, and that the product contains, or is liable to contain, the germs of disease; and that, in cleansing these diseased and filthy fats, dangerous chemicals are used, which are not subsequently completely removed.

That the fats used are of themselves unwholesome, there is no proof whatever. They contain nothing that butter-fat does not also contain, and differ from it only by the absence of about six per cent of the glycerides of certain soluble fatty acids; viz., caprinic, caprylic, capronic, and butyric acids. The only experiments upon the digestibility of imitation butter are two, by A. A. Mayer, upon oleomargarine. These showed a difference of only about two per cent in favor of butter. That the higher flavor of butter acting upon the nervous system would give it a greater nutritive value than the flavorless 'neutral' or 'oleo,' may be conceded; but that an article which even experts fail to distinguish from genuine butter is at any serious disadvantage in this respect, may well be doubted.

The manufacturers claim that imitation butter can only be made from the best quality of fat from freshly killed animals, and I know of no evidence which disproves their assertions. The sensational article recently published in a prominent agricultural paper in the north-west, accompanied by cuts of the numerous organisms found in butterine, is of no significance in this connection, both because the species described are all harmless, and because no comparative examinations of genuine butter were made. It is highly probable that many samples of the latter would show as miscellaneous an assortment of formidable-looking, harmless organisms as did the butterine.

On the other hand, however, there is at present no guaranty, except the statement of the manufacturers, that diseased fat is not or can not be used; the manufacture being conducted entirely without any official inspection, and visitors being in most (not all) cases excluded. I believe that the chances of disease being conveyed in this way are small, but they are not yet proved to be non-existent.

As regards filthy processes of manufacture, it may safely be asserted that butterine could not successfully imitate butter were it not as clean as most things are which pass for clean in this dirty world.

The charge that dangerous chemicals are used in the manufacture may be disposed of in a few words. If a dangerous amount of any chemical which is claimed to be used were left in the finished product, the latter would be inedible. Should traces of these chemicals be found, their significance would not lie in themselves, but in the indication they would furnish that the original fats were impure and required chemical treatment.

Fraudulent sale. — The evil feature of the trade in imitation butter is that it is largely fraudulent.

A prominent manufacturer of butterine lately told the writer, in response to an inquiry, that, in his opinion, not over twenty-five per cent of the butterine made in the United States is sold under its true name. It may safely be assumed that the estimate is not too low, and that fully three-quarters of the product is eventually sold and eaten as butter. Reliable statistics of the production of imitation butter are not to be obtained, so far as I have been able to find, but it must be enormous. The fact, which is stated on good authority, that Chicago, one of the chief seats of the manufacture, exports more 'butter' than it imports, is suggestive in this connection. The manufacturer, it may be assumed, sells his product as an imitation, though even here facilities for deception are afforded in the use of such names as 'creamery' and 'dairy' butterine, and in the branding of packages with the names of imaginary creameries. But as the imitation passes through the hands of jobber, retailer, and restaurant or boarding-house keeper, to the consumer, it undergoes a transformation, until, at the end, it is the exception when it is not butter simply, with no suffix. Since the imitation can be produced much cheaper than the genuine article, and can with difficulty be distinguished from it, it affords a tempting opportunity to the middleman to increase his profits. As a natural result, the manufacture of and trade in genuine butter have suffered under this unfair competition, and a wide-spread change in the butter trade of the cities is taking place. Consumers, wisely or unwisely, are generally very averse to eating butterine at all, as well as to paying the price of butter for it, and in self-defence are coming more and more to make contracts for butter directly with reliable producers, to the benefit of both parties and the injury of the middlemen, who seem now to be in a fair way to reap as they have sown.

Legislation. — The undoubted injury to the dairy business wrought by the manufacture and fraudulent sale of butterine and oleomargarine has been the incentive to an earnest search for a remedy; and the aid of legislation was speedily invoked, first in the shape of laws to compel the branding of every package of these articles, and, later, of laws prohibiting entirely their manufacture and sale. Neither class of laws proving effective, and the New York law having been pronounced unconstitutional by the court of appeals, the aid of national legislation is now being invoked.

Several bills upon this subject have been introduced into the present congress; but the one which has become most prominent, and has apparently met with the most favor from the opponents of butterine, is the substitute bill reported by the committee on agriculture, by which it is intended to indirectly prohibit the manufacture of imitation butter. There are numerous minor provisions; but the main ones, which render all others superfluous, are the imposition of a license-fee of six hundred dollars upon every manufacturer, four hundred and eighty dollars upon every wholesaler, and forty-eight dollars upon every retailer, and of an internal revenue tax of ten cents per pound upon all imitations of butter manufactured or imported, the tax upon the latter being in addition to the customs duty. The internal revenue department is charged with the execution of the law. In short, it is proposed to tax the business out of existence.

The writer does not hesitate to express his belief that the enactment of this law is not desirable. As is evident from the description already given of the process of manufacture, and as the writer is convinced by personal inspection, imitation butter, when properly made, or when made as the manufacturers claim that it is, is a perfectly cleanly, wholesome article of food. Granting this, the prohibition of its manufacture is simply class legislation, designed to advantage the producer of butter by increasing the price of his product, to the detriment of the consumer. The dairy interest of the country is undoubtedly of great magnitude, and may well be fostered in all legitimate ways; but no interest has the right to be 'protected' at the expense of the whole people.

Another objection to a heavy tax on this article, unless it be absolutely and hopelessly prohibitory, is that it will tend to stimulate exactly what appears to be now the greatest danger connected with the manufacture of butter-substitutes. In addition to the pressure of competition, we should have the pressure of taxation forcing the manufacturer to seek cheaper and cheaper sources for his raw materials, and tempting him to use unhealthy fats, if he can do so without detection.

Further, the writer ventures to doubt whether the permanent injury which this manufacture will work to the dairy interest will be so great, or the advantage of its suppression so marked, as is commonly supposed, provided that the imitations are compelled to be sold for what they are. Butterine, undoubtedly, has depressed the price of butter, partly by displacing it, and partly by creating a general distrust of the genuineness and wholesomeness of what is offered to the consumer as butter. It is worth considering, however, to what extent this would be offset, in time, by the increased consumption of butter, both *per se* and in butterine, which will presumably follow from its lower price.

But while the writer does not advocate legislative prohibition, he does most strongly believe in the necessity for legislative regulation. The objects to be attained by such regulation are, first, to insure that only clean and wholesome materials are used in the manufacture, and that the process is conducted in a careful and cleanly manner: and, second, to compel the sale of the product under its own name and on its own merits. When this is done, all is done that the state can properly do.

Space forbids entering into any discussion of the best methods of reaching these objects. Some system of registration and inspection of factories would evidently be necessary to accomplish the first; while the second might be attained by compulsory branding of packages, use of a peculiar style of package, requiring manufacturer and jobber to keep a record of all packages sold, with name of buyer, and numerous other devices. Probably both these objects would be most readily accomplished by putting the whole matter in the hands of the Internal revenue bureau, while it might fairly be taxed sufficiently to cover the cost of inspection, etc.

Finally, it is to be remembered that butterine is but one of many forms of food-adulteration. The most satisfactory treatment of the subject would be the enactment of general laws, state or national, upon the subject of food-adulteration, and the provision of an efficient power to enforce them.

Methods of detection. — There is no simple test by which the consumer may determine for himself whether a sample of butter is genuine: the adulteration can be detected only by the expert chemist or microscopist. Butter, as already noted, differs from all other animal and most vegetable fats, in containing about six per cent of the glycerides of certain soluble fatty acids. It is upon this fact that all chemical methods for the detection of butter-adulteration are based. The original method, as proposed by Hehner, consisted in determining the percentage of insoluble fatty acids. In butter this averages about 87.5 per cent, while in other animal fats it averages about 95 per cent. Koettsdorfer determines the weight of pure potash required to saponify one gram of the fat. Owing to the lower molecular weight of the peculiar acids of butter, more potash is required to saponify this fat; the range being 221 to 232 milligrams of potash for butter, and 195 to 197 for other fats. Reichert, after saponifying the fat and setting free the fatty acids again by addition of sulphuric acid, all the operations being conducted in a uniform manner, distils over a fixed volume of the resulting liquid, and determines the amount of potash required to neutralize it. The distillate from 1 gram of butter-fat requires 13.0 to 14.9 cubic centimetres of a deci-normal potash solution; that from other fat, a fraction of 1 cubic centimetre.

Of these methods, Hehner's is too tedious for ordinary use; Koettsdorfer's is very readily and quickly applied, and in general gives unequivocal testimony as to the genuineness of the sample; Reichert's requires somewhat more time and skill than Koettsdorfer's, but still is a simple method, and gives trustworthy results, and has advantages in certain cases.

The results obtained by either of these methods may evidently serve as the basis of an approximate computation of the extent of the adulteration. Owing to the somewhat variable composition of butter, however, the approximation cannot be a very close one, and slight adulterations would pass undetected. It will not often be the case, however, that butter is slightly adulterated; so that practically but little difficulty will arise from this fact, so far as the detection of the falsification is concerned. For a calculation of the extent of the adulteration, Reichert's method has proved the more satisfactory in my laboratory, Koettsdorfer's giving usually decidedly too low results.

Cornwall[1] has recently called attention to the fact that cocoanut-oil is said to be used in the manufacture of butterine. This oil, unlike most others, contains a considerable proportion of soluble fatty acids; and mixtures of this fat with oleo-oil or neutral may be made which behave exactly like butter with Hehner's or Koettsdorfer's tests. They may be distinguished, however, according to Cornwall, by Reichert's method, the soluble acids being much less volatile than those of butter; the distillate containing, consequently, but little of them.

Besides the chemical methods, the more important of which have been described, various attempts have been made to devise optical tests, but with indifferent success. Among others, Dr. Thomas Taylor, microscopist of the U. S. department of agriculture, has described a method which has received such extensive notice as to merit a few words. He proceeds substantially as follows: some butter is melted and 'boiled' for a short time (that is, the water which it contains is boiled), and then allowed to cool slowly. A small portion of the solidified butter is mounted in a little olive-oil on an object-glass, and under the microscope is seen to consist of irregular globular masses consisting of aggregations of fat-crystals. When these are examined with polarized light in the dark field, each shows a pretty well defined St. Andrew's cross. Dr. Taylor's original claim was that these globules, and particularly their ap-

[1] Report of New Jersey state board of health.

pearance by polarized light, were peculiar to butter, and could serve as a means of distinguishing it from imitations ; and the commissioner of agriculture, in his last report (p. 36), states, that, at the time of writing, two convictions for violations of the butter-laws had been secured in the District of Columbia by the aid of Dr. Taylor's method.

Professor Weber, of the Ohio state university, however, has recently shown that lard and oleo-oil do not differ essentially from butter in this respect. By 'boiling' the butter as Dr. Taylor directs, some of its water is removed, and a formation of minute salt-crystals takes place. As the butter cools, these minute crystals of salt serve as neuclei for the formation of the butter-globules. Professor Weber shows that if melted lard or tallow be allowed to cool under the same conditions, they too form globules which exhibit the St. Andrew's cross.

In an open letter to Dr. E. Lewis Sturtevant, director of the New York agricultural experiment-station, Dr. Taylor attempts to break the force of Professor Weber's experiments, and also shifts his ground, claiming that the distinguishing difference between butter and other fats under the microscope is that the former, when viewed by polarized light through a selenite, shows a uniform tint, while the latter exhibits prismatic colors.

Whether this claim rests on any better foundation than the former, the writer will not undertake to say ; but it is plain that further investigation would not be out of place.

H. P. ARMSBY.

ENGLAND'S COLONIES.

THE opening of the Colonial and Indian exhibition at South Kensington gave rise to an article in the London *Times*, on the growth of England's colonial possessions. The Portuguese and Spaniards, and even the French, were in the field long before England. Spain had a settlement in Dominica as early as 1493, and Vasco da Gama reached India in 1498. Within very few years India and South America had their Portuguese and Spanish viceroys. In 1534 Jacques Cartier made his famous voyage up the St. Lawrence, taking possession of the country in the name of the French sovereign. True, Cabot discovered Newfoundland and the mainland of North America in 1497 ; but he, like other early western navigators, simply regarded the new world as a barrier on the way to India. It was this latter land of fabulous riches that was the goal of the infant naval enterprise of England for many years after Cabot's discovery. The Portuguese monopolized the routes by the southern seas, and England had not yet a navy to cope with its rival.

So effort after effort was made, in craft not much more formidable than cock-boats, to find a passage to India either by the north-west or north-east. Not till our own days have these passages been sailed over; but long before had they been given up as hopeless routes to China and India. Many a life did these early attempts cost England ; but to them, no doubt, is greatly due the rapid progress she made as a naval power.

Up to the end of the sixteenth century, while Portugal and Spain were rapidly extending their sway in Asia and America, England had only a doubtful possession of Newfoundland along with powerful French rivals. Even Sir Humphry Gilbert's attempt to effect a settlement on the island in 1583 can hardly be regarded as other than abortive, though it gives Newfoundland a claim to be regarded as the earliest British colony. The first effective English settlement on the island cannot be dated earlier than 1623, long before which Virginia had been planted and Jamestown founded. True, in 1580 the British flag was planted in the West India island of Tobago, but that island was not effectively occupied by England till 1763.

Meanwhile, some roving Englishmen had in 1605 planted a cross in Barbadoes, inscribed 'James, king of England and of this island,' though there was no actual settlement till 1625. Barbadoes is one of the two or three British West India islands that never changed hands. After all, however, Bermuda may fairly claim to be considered the earliest of existing English colonies, as it was colonized both from Virginia and England shortly after 1609. But later, during the seventeenth century, the growth of England's colonial possessions was slow, if we except the New England states and the settlements on the east American coast to the south. Leaving these last out of view, her colonies at the close of the century were few and scattered, compared with the enormous territories which Portugal and Spain, France and Holland, were endeavoring to drain of their wealth. Even in India, during the seventeenth century, she can hardly be said to have got beyond the factory stage. The East India company were simply lease-holders of the native princes. Newfoundland, as already indicated, was only permanently settled in 1623, fourteen years after the planting of Bermuda. In the same year an English colony was planted in Nova Scotia, which then included New Brunswick, though it was only at the peace of Utrecht (1713) that England can be said to have obtained undisputed possession.

With one or two exceptions, England's footing in the West India Islands during the seventeenth and even the eighteenth centuries was exceedingly unstable: they were being continually bandied about between England, France, and Spain before the final adjustment at the beginning of the present century. As stated above, an effective settlement was made in Barbadoes in 1625. Two years previously some Englishmen established themselves in St. Christopher's, which, however, was not finally ceded to Great Britain till 1713. Between 1628 and 1650, Nevis and Turk's Island, Antigua, Montserrat, St. Lucia, and Anguilla received English settlers, though St. Lucia, at least, changed hands several times before finally becoming English, in 1803.

Crossing over to Africa, we find, that, as early as 1588, Queen Elizabeth granted a patent to a company to trade to the Gambia; but no settlement seems to have been established till 1631, and even that can hardly have come to much, since a resettlement was made in 1817. Still there was a very considerable trade between England and West Africa in the seventeenth century, and Gambia and other stations became notorious as centres of the slave-trade. But their value for colonizing and trading purposes soon sank far below that of the West Indies and other annexations.

St. Helena became hers by capture in 1651; and four years later (1655) Jamaica, the largest and richest of her West India possessions, capitulated to an expedition sent out by Cromwell. English factories seem to have been established on the Gold Coast in 1661, and her first settlement on the Virgin Islands dates from 1668. A small English colony was planted in New Providence in the Bahamas in 1629, though she had frequently to give up possession before the islands finally became hers, in 1783.

Meantime, England was rapidly extending her sway over the eastern coast of what is now the United States; and these possessions, even in the seventeenth century, were of far greater importance than all her other acquisitions.

At the end of the seventeenth century, then, besides Newfoundland and Bermudas, and a few factories on the West African coast and in India, of the present colonial empire England had possession, more or less stable, of Jamaica, Barbadoes, St. Christopher's, Nevis, Turk's Island, Antigua, Montserrat, Anguilla, Virgin Islands, Bahamas, and St. Helena out in the Atlantic. The total area of these did not much exceed sixty thousand square miles, for her African and Indian settlements were little more than stations. Even if we added such parts of Nova Scotia and New Brunswick as were not occupied by France, the total area could scarcely be more than eighty thousand square miles.

During the first half of the eighteenth century, if we except the confirmation to Great Britain of the ten North American colonies just mentioned, and one or two of the West India islands already included, the only acquisition of importance as a foreign possession was Gibraltar (1704), and that not as a colony, but as a strategical station.

A period of comparative quiescence prevailed during these fifty years previous to the outbreak of the great and long-continued struggle between England and France for supremacy on the seas, if not on land. During the first half of the eighteenth century The East India company's business was steadily extending in India. Comparatively few additions were made to the English possessions on the North American coast. France claimed all Canada, only tolerating the station of the Hudson's Bay company, founded in 1670, and holding the Alleghanies as the western limit of English dominion. The position in the West Indies remained essentially unaltered, though the development of the English plantations in that region was proceeding with profitable activity. The few factories on the West African coast were of little account, the Dutch were still supreme at the Cape, and Cook was only beginning his career in the Royal navy.

During the last forty years of the eighteenth century, on the other hand, the broad foundations of England's empire beyond the seas were firmly laid; subsequent operations have mainly been in the way of development and consolidation. The great struggle between England and France for supremacy beyond Europe may be said to have begun simultaneously in India and Canada. On the latter field it resulted in the capitulation of Quebec in 1759, followed four years later by the cession of the whole of Canada; so that England was virtually mistress of the whole of North America. In 1776 the declaration of independence was signed, and in 1783 England had to resign herself to the loss of by far the most valuable half of her dominions in America.

In the same year as Canada became an English possession, the islands of Dominica, Granada, St. Vincent, and Tobago were added to her West Indian possessions, followed in 1797 by the surrender of Trinidad to Abercrombie by the Spaniards. Although Commodore Byron took possession of the Falkland Islands in 1765, no effective establishment was formed there till 1833. In 1783–86 British Honduras was acquired by treaties; in 1787 Sierra Leone was ceded by the native chiefs; while in 1788, not quite a century ago, the not

very promising foundation of the great Australasian group of colonies was laid by the establishment of a small convict establishment at Botany Bay.

Turning to the east, we find Malacca captured from the Dutch in 1795, though it did not finally become English till 1823. Penang was colonized in 1785, and Province Wellesley in 1798. Much more important was the capture of Ceylon from the same once supreme colonial power in 1796. The battle of Plassey was fought in 1757, and within about half a century thereafter, through the genius of Clive and Hastings and Wellesley, English supremacy was virtually established, directly or indirectly, over a great part of the Indian peninsula. Bengal was ceded in 1765, and Madras conquered in 1792–1800, having between them an area estimated at two hundred and ninety thousand square miles, and a population of fifty-five millions.

Thus, then, during the latter half of the eighteenth century, England had succeeded in rapidly increasing her foreign possessions by something like six and a half millions of square miles, reckoning the whole of Australia as virtually annexed. During the present century she has been able to increase this area by about one-third, half of it, at least, in India. While, during the last eighty-six years, she has been extending and confirming her hold over India, and while she has acquired one or two really important additions to her colonial possessions, it will be seen that her chief work has been to develop and consolidate the acquisitions of the latter half of the eighteenth century.

In the West India region, British Guiana was finally annexed in 1803, and St. Lucia in the same year, thus completing the present list of her possessions in that quarter. Also in 1803 the first settlement was established in Tasmania. While in this quarter, twenty-six years later (1829) West Australia was settled, followed, seven years after (1836), by the modest beginnings of South Australia at Port Philip. In 1841 New Zealand began her wonderful career as a British colony. Ten years later (1851) Victoria separated from New South Wales, and set up for herself, — an example followed by Queensland in 1859. In 1806 the Dutch were compelled to hand over to England their possessions in South Africa, which by the formation of the Natal colony in 1838, and other subsequent annexations, have been extended far beyond their original boundaries. In 1807 England captured the tiny islet of Heligoland, and three years later (1810) Mauritius capitulated, her possession of the island being confirmed by the treaty of Paris, 1814. A year later (1815) she acquired the Ionian Islands by treaty, only to give them up to Greece some fifty years after; and in the same year she established her naval station in Ascension. Singapore was settled in 1818, and the Falklands in 1833. Aden as an outpost of India was occupied in 1833. Labuan was ceded in 1846, followed by Lagos in 1861, and Fiji in 1874. The Straits Settlements were detached from India in 1867, and set up for themselves as a separate colony; and in 1874 the native states of Perak, Selangore, and Sungei Ujong, were placed under its protection.

We all remember the excitement over the occupation of Cyprus in 1878; and while England pays tribute for it to the sultan, her real relation to the interesting island is indicated by the fact that it figures among her other colonies at South Kensington. The British North Borneo company was incorporated by royal charter in 1881; and the fact of its having a court to itself at South Kensington may be taken as a tacit admission that its territory is reckoned among her colonies. England has hardly yet recovered from the excitement of raising the British flag over southern New Guinea, the Niger mouths, and Bechuanaland, in 1884; while at this very moment her soldiers and civil servants are busy getting into working-order the extensive territory of upper Burmah, proclaimed English on the first day of the present year. This last annexation, however, belongs rather to the record of her dominion in India, which has advanced so rapidly that the two hundred and ninety thousand square miles and the fifty-five million inhabitants of 1800 have grown to something like a million and a half of square miles and two hundred and eighty millions of population. To the above might be added such outlying spots as the Kuria-Muria Islands, the Keeling Islands, and Port Hamilton, in Asiatic waters; Berbera on the north-east African coast, and Socotra off it; the islands of Rotumah, Auckland. Lord Howe, Caroline, Starbuck, Malden, and Fanning, in the Pacific; not to mention the Nicobars and Andamans, attached to India.

Thus, then, while the beginnings of the greatest colonial empire on record go back some three hundred years, by far the greater proportion of England's foreign possessions have been acquired during the last hundred and twenty years.

LONDON LETTER.

THE *conversazione* of the Royal society, on Wednesday evening last (May 12), was even more successful than usual, special pains having been taken to bring together objects of interest. Partly, perhaps, on this account, and also because it was the first reception of the new president, Prof. G.

G. Stokes, the attendance also was unusually brilliant. Prominent among the exhibits was a microscopic section of the third or parietal eye discovered three days previously in the New Zealand lizard, Hatteria punctata, by Mr. Baldwin Spencer of the University museum, Oxford, who has described it in full in *Nature* for May 13. Mesial sections of a frozen chimpanzee and a frozen orang-outang, by Prof. D. J. Cunningham, attracted much attention, as did a collection of micro-organisms by Mr. F. R. Cheshire, and of photomicrographs of bacteria by Mr. E. M. Crookshank. To chemists, specimens of the new element germanium, which appears to be the ekasilicium predicted by Mendellieff in his periodic law (lent by Professor Winkler of Freiburg), were specially interesting. Mr. Howard Grubb exhibited a model of the proposed equatorial and observatory for the great 36-inch refractor for the Lick observatory in California, in which *all* the required motions of telescope, dome, and rising floor are effected by water-power, and are controlled by an electrical arrangement, the commutator of which is portable, and carried by the observer, thus obviating the necessity of assistants. Various electrical appliances, such as the powder-magazine lamps of Mr. J. Pitkin, weighing six pounds, and lasting ten hours, De la Rue's chloride-of-silver battery, arranged for electric lighting, and the miner's electric lamp of Mr. Swan, illustrated the advances in practical electricity; the chief object of purely scientific interest in this connection being the voltaic cells, with solid electrolytes, described by Mr. Shelford Bidwell in the *Philosophical magazine* for October, 1885, and the induction bridge of Professor Hughes. Objects connected with the Hell Gate explosion, near New York, exhibited by Dr. H. Sprengel, were shown, and near them was a new and extremely powerful electrical-influence machine with eight disks working within a glass case. Captain Abney and General Festing exhibited their color-photometer; and several series of stellar and solar photographs by the brothers Henry, Janssen, the solar physics committee, Common, Dr. Gill, and others, illustrated the recent advances in celestial photography. Dr. Auer von Welsbach's incandescence system of burning gas, whereby a light of twenty-five candle-power was obtained with a consumption of two and one-half cubic feet per hour, attracted much attention. An ordinary Bunsen flame is used, the incandescence being obtained from a cylindrical 'wick' of net or muslin soaked in a solution of metallic salts, zirconium being one.

The arrangements for the Birmingham meeting of the British association are now completed. On Wednesday evening, Sept. 1, the president-elect, Sir William Dawson, of the McGill college, Montreal, will deliver his address. The other two evening discourses at general meetings will be on Sept. 3, by Prof. W. Rutherford, on 'The sense of hearing;' and on Sept. 6, by Mr. A. W. Rücker, on 'Soap-bubbles.' The various sections will be presided over by (A.) Prof. G. H. Darwin, (B.) Mr. W. Crookes, (C.) Prof. T. G. Bonney, (D.) Mr. W. Carruthers, (E.) Maj.-Gen. Sir F. J. Goldsmid, (F.) J. Biddulph Martin, (G.) Sir J. N. Douglass, (H.) Sir George Campbell. The meeting will conclude on Wednesday, Sept. 18.

The Colonial and Indian exhibition, opened by the queen on May 4, with an amount of public and state ceremonial not seen since the corresponding ceremony in 1851, well illustrates in many ways the advances in practical science made in the various colonies. The grounds are lighted every evening by 9,700 glow-lamps, which are simultaneously illuminated, the current for which is supplied by four Elwell-Parker self-regulating dynamos, each of which can supply a current of 250 ampères with an electromotive force of 250 volts when running at 300 revolutions. The official catalogue contains a vast mass of statistical information, most carefully compiled, relating to the history, recent advances, and present condition, of India and the chief colonies.

The still exceptional weather deserves a word of comment. On the night of April 30, 13° of frost were registered close to London; on the afternoon of May 7, 79° in the shade, and 130° in the sun, were registered at the same place. The temperature that week was 6° above the average; and at the present moment (May 15) accounts are coming to hand of floods in all parts of the country heavier than have been experienced for many years, by which railway embankments and bridges have been wrecked, while in the north of Scotland and Ireland severe snow-storms have occurred. The details of the ten-minutes hurricane at Madrid two days ago, which uprooted two thousand trees, wrecked several houses, palaces, etc., killed twenty-four people and injured hundreds, and devastated a large country district, read more like those of the American or tropical tornadoes than of any thing known in Europe.

The Iron and steel institute has just been holding its three-days' annual meeting in London, under the presidency of Dr. Percy, who contributed two papers himself, — on steel wire of high tenacity, and on a rare blast-furnace cinder. Mr. F. W. Gordon of Philadelphia furnished an account of some points in American blast-furnace practice. The international character of the institute was shown by the fact that one-third of

the papers were by other than British subjects. Dr. Sorby's paper on the application of very high powers to the study of the microscopical structure of steel was probably the paper of most purely scientific interest.

On May 12 occurred the annual presentations for degrees at the University of London, when a very large number of graduates of both sexes had their degrees formally conferred. The chancellor, Lord Granville, being in attendance on the queen at Liverpool, the ceremony was performed by the vice-chancellor, Sir James Paget, who, after referring to the loss sustained by the university in the deaths of Dr. Carpenter and Dr. Storrar (both noticed at the time in this correspondence), gave some interesting statistics of its growth. It was now fifty years old, and 54,630 students had graduated. In 1838 it only had 23 candidates; in 1860, 788; and in 1885, 3,477. With its numbers its influence had increased, and it attracted students from all the colonies and from India, as well as from England. Among its distinguished graduates were Sir H. Roscoe, Sir W. Jenner, Lord-Justice Fry, and the present lord-chancellor. At the meeting of convocation on the previous day, a scheme for degrees in engineering science was, on the motion of Prof. W. C. Unwin and Mr. W. Lant Carpenter, unanimously adopted, and sent up to the senate for consideration. A movement is in contemplation to celebrate the jubilee of the university.

In an interesting paper given last night before the Society of telegraph engineers, upon long-distance telephony, by Mr. W. H. Preece, the system of trunk-line (American, 'extra territorial') working was described, and some very curious statistics were given. At the end of 1877, 780 telephones existed in the United States, and at the end of 1885 there were 325,570 telephones, and 782 telephonic exchanges. In England at the same date there were only 13,000, or about as many as were used in New York and Brooklyn alone; while Canada, with its population of three millions, employed 18,000. Of European cities, Berlin possessed the most, 4,248, London coming second with 4,193. The most complete development he had seen in any country was in the group of towns of which Newcastle-on-Tyne was the centre. Long-distance speaking was entirely a question of line wire, not of instruments. M. Van Rysselberghe spoke in the discussion, and detailed some of his recent experiments in the states. He is about to connect Paris, Brussels, Amsterdam, and Rotterdam by his simultaneous telegraphic and telephonic arrangements.

The report for 1885, of the inspectors on experiments on living animals, under the vivisection act, has just been issued. The total numbers of experiments was 800; 210 being done under the restrictions of the license alone, and 82 lecture demonstrations under similar restrictions. In all, except those under a special certificate, the animal is rendered insensible during the whole of the experiment. In most of the experiments where anaesthetics were dispensed with, the operation was simple inoculation or hypodermic injection; so that the number of animals that suffered any appreciable pain was 35 or 40, and these, for the most part, frogs. Although the number of experiments in 1885 was nearly double that in 1884, there was no increase of suffering to the animals employed.

The report of the inspector of fisheries has just been issued, and gives interesting details on the trade in eels between London and the continent. From Holland 1,000 tons are sent annually to Billingsgate (London) alone, the total annual value of eels consumed in England being about two and a half million dollars. An admirable contrivance is described for reviving them from their exhausted condition on arrival. At the Society of arts this week, Mr. J. Willis Bund read a paper on the proposed fishery board for England and Wales, showing that their fisheries had relations at present with at least five government departments: viz., the home office, the foreign office, the admiralty, the customs, and the board of trade. The total value of the English and Welsh fisheries was probably between eight and ten million dollars, but an annual statistical account of them was a very great want.

Mr. W. Bateson of St. John's college, Cambridge, is about to proceed to Central Asia for the purpose of investigating the fauna of the Sea of Aral and the smaller lakes in its neighborhood. Mr. Bateson is already well known as a morphologist, having paid two visits to the Chesapeake zoölogical laboratory of the Johns Hopkins university for the purpose of studying the development of the American species of Balanoglossus; and he now proposes to collect large numbers of the Mollusca and Crustacea of the Central Asian lakes, for the purpose of studying the range of variation within specific limits. W.

London, May 14.

NOTES AND NEWS.

ALTHOUGH the university of the state of New York exists only on paper, yet its annual convocations are meetings of considerable scientific interest and importance. This year the convocation will be held at Albany on July 6, 7, and 8. The announcement includes the following important papers, all of which will be followed by a discus-

sion of the subjects presented: Tact in teaching, by Rev. Brother Noah, professor of English literature in Manhattan college; Manual training, by Principal S. G. Love of the Jamestown union school; The present status of entomological science in the United States, by J. A. Lintner, Ph.D., state entomologist; Has the college a logical place in the American system of education? by Prof. Oren Root, Ph.D., of Hamilton college, and Prof. S. G. Williams, Ph.D., of Cornell; The 'natural method' of teaching languages, by L. Sauveur, president of the College of languages, New York City, and Principal George C. Sawyer of the Utica free academy; The educational uses of museums of natural history, by James Hall, director of the New York state museum of natural history: Systematic habit in education, by Principal E. H. Cook of the Potsdam normal school; Elective studies in college, by President James McCosh, LL.D., of the College of New Jersey; The mutual relations of the colleges and academies, by President Charles K. Adams, LL.D., of Cornell university. There will also be a conference upon college education in the state of New York, which will be presided over by Chancellor Sims of Syracuse university, who will open the discussion as to the classical requirements for the degree of A.B. Among those who intend to participate in the conference and discussions are Presidents Dodge of Madison university, Darling of Hamilton, Potter of Hobart, Fairbairn of St. Stephen's, Ryan of Niagara university, Webb of the College of the city of New York, Adams of Cornell, Taylor of Vassar, and Forsyth of the Rensselaer polytechnic institute.

— The Indiana academy of sciences held its field-meeting at Brookville, May 20 and 21. The days were spent in field-work, and the academy held meetings at the town-hall in the evenings. On the evening of May 20, the academy was welcomed by D. W. McKee, president of the Brookville society of natural history. To this President D. S. Jordan responded. Prof. J. C. Branner delivered an address on "The relations now existing between geologists and the people." Friday evening Prof. D. S. Jordan delivered an address on 'Darwin,' which was discussed by Prof. D. W. Dennis. Prof. Jordan then spoke concerning the different methods employed in catching fish. Prof. Branner gave an account of the ways in which corals are procured. Prof. P. S. Baker spoke of 'The progress of toxicology.' The academy will hold its annual meeting at Indianapolis in December next.

— The opening of the Carnegie laboratory a year ago, and the endowment of hospitals by the Vanderbilt family, have been followed by the announcement of two new laboratories for the advancement of medical science, — one in Brooklyn, and the other in New York. The former will be known as the 'Hoagland laboratory of the Long Island college hospital,' and is the gift of Dr. C. N. Hoagland, a physician of Brooklyn. It will be devoted to bacteriological, physiological, and pathological purposes, and will be equipped with all the best modern appliances, together with a select library and museum. It is intended not only as a means of teaching the students of the college, but also as a place where physicians and others desirous of prosecuting original investigation can find the necessary apparatus and facilities. The new laboratory to be established in New York is to be known as the 'Loomis laboratory,' and is to be in connection with the University medical college. The name of the donor is still unknown, but the name it is to bear is a tribute of respect to the well-known teacher, Prof. A. L. Loomis.

— The first annual meeting of the University science club, of the University of Kansas, was held Friday, May 21. The programme, as arranged, was as follows: E. H. S. Bailey, On the viscosity of fats and oils; L. L. Dyche, Methods of studying the food-habits of birds; J. D. McLaren, Notes on Pogonomyrmex occidentalis (agricultural ants of Kansas); Richard H. Short, A determination of the force of gravity on Mount Oread; R. L. McAlpine, A determination of the accuracy of the solar attachment to the engineer's transit; E. C. Franklin, on a variety of orthoclase from Haddam, Conn.; L. E. Sayre, A new appliance for the rapid collection of precipitates; F. H. Snow, The transitional character of the essential organs in the white maple (Acer dasycarpum); W. S. Franklin, A modification of Le Clanche battery; F. O. Marvin and Richard Birbeck, Gauging of the Kansas River; V. L. Kellogg, Bird parasites; J. D. McLaren, The structure of Unio laevissimus; E. L. Nichols and W. S. Franklin, On the influence of magnetism upon electromotive force; E. H. S. Bailey and S. H. Wood, Note with reference to the effect of boiling upon the solubility of tannin in coffee; F. H. Snow, Some results of eighteen years of meteorological observations at Lawrence, Kan.

— The following comprise the latest changes in the coast and geodetic survey; Professor Davidson has finished his work on astronomical latitude observations at Portland, Ore., and is about to return to San Francisco; Assistants Lawson and Dickens are at work near Los Angeles, while Assistant Rogers has finished the work of resurveying on the Straits of Karquines, at the mouth

of the Sacramento River, and is now making a resurvey in the vicinity of Golden Gate; various acting assistants in the coast and geodetic survey are preparing to take the field the first of June, to continue the work of furnishing points and data to different state surveys, Professor Buchanan going to Tennessee, Professor Campbell to Indiana, Professors Barnard and Merriman to Pennsylvania. Chart No. 2, from the mouth of St. John's River to Jacksonville, Fla., embracing the latest hydrographic work, and the improvements of the jetties at the mouth of St. John's, is now ready for distribution to agents.

— At a meeting of the Royal geographical society on May 11, a paper was read by Prof. W. M. Ramsay on 'Roman roads and English railways in Anatolia.' Before the reading of the paper, the chairman announced that royal medals had been awarded to Major A. W. Greely, commander of the U. S. Arctic expedition of 1881–84, for having so considerably added to our knowledge of the shores of the Polar Sea and the interior of Grinnell Land, and for the narrative of the expedition which he has just given to the world; and to Signor Guido Cora, for his important services as a writer and cartographer in advancing geographical knowledge, promoting the study of geography, and defining its position as a science. Professor Ramsay's paper detailed the results of his researches into the system of Roman roads in Anatolia, and the conclusions to be drawn from those researches as to the considerations which influenced the Romans in the formation of those roads.

— Another comet in Virgo was discovered Saturday morning, May 22, by Mr. Brooks. As determined by Professor Swift at the Warner observatory at ten o'clock Sunday evening, its position was, right ascension, 11h 51m 15s; declination, north 8° 55′ 15″. It has a slow motion south-east. It is very large, but faint. This discovery secures to Mr. Brooks the three first Warner prizes of the year.

— Commodore George E. Belknap has been detached from duty as superintendent of the naval observatory at Washington, and ordered to command the Mare Island navy-yard, California, about the middle of June. Lieutenant Bowman and Ensign Taylor have also been detached from the observatory. Commodore Belknap's successor has not been announced.

— The executive committee of the International institute of statistics met at Cologne on May 1, 2, 3, and 4. The members present were Sir Rawson W. Rawson (England), president; M. Levasseur (France), Herr Hofrath Neumann-Spallart (Austria), M. L. Bodio (Italy), and Mr. John B. Martin (England). It was decided that the meeting of the institute this year should be held at Rome, from Sept. 23 to Sept. 29. The programme was drawn up, and a list of subjects to be discussed adopted.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A new museum pest.

IN a collection arranged to illustrate a course in paleontology at the Museum of comparative zoölogy, a new set of labels was introduced last year, which has since been very much injured by the attacks of an insect, Lepisma domestica, — the silver-fish, in popular language. The labels are similar in plan to those which are used in the paleontological department of the national museum. They are made of thick paper, heavily sized with starch, with headings, and a border-line printed in black ink. They are bent at a right angle in the middle. The specimen is set on the lower half, while the description of the same is written on the upturned portion, rendering it visible without the necessity of lifting the specimen, — a distinct advantage, especially for class-room use. There are about seven hundred labels in use, and all, at the time of examination, had been written within ten months; yet not a single one had wholly escaped from the attacks of Lepisma. Many were eaten enough to obliterate the writing, and riddle the paper with holes; and all gradations between slight and extensive injury exist. Paper trays in which the specimens are kept, and which apparently contain no sizing, are not at all eaten. The labels are eaten on all parts except underneath, where pressed against the paper tray by weight of the specimen. The parts covered with printer's or writing ink are eaten quite as much as those which are not, contrary to the observations of others cited below. Careful search in the early winter led to the discovery of perhaps half a dozen specimens of Lepisma, but none have been seen since.

I have seen labels written on various kinds of paper, in the same and other departments of the museum, eaten by Lepisma; also a photograph, wall-paper probably, and an old engraving in New York. In this last the white portions were most affected, but some parts closely covered with printer's ink were eaten.

I have made many inquiries from naturalists and others, concerning the destruction done by Lepisma; but to most it was new. The late Prof. C. E. Hamlin of the museum said he had seen paper eaten, and titles eaten off the backs of books, where they had been attached by starch paste, but was confident that unsized paper was never affected. Prof. R. P. Whitfield of the American museum said that he had known injuries to labels to have been committed by Lepisma. Prof. F. W. Putnam, of the Museum of archeology and ethnology, showed me many labels which had been eaten, or entirely reduced to powder, by Lepisma. Mr. S. Henshaw, of the Boston society of natural history museum, had known of injuries, and, enclosing Lepisma in a jar with paper, found that the insects eat large holes in it.

It is clear that Lepisma, if not a very common visitant to museums, is at least a dangerous one when it does appear, and it behooves naturalists to be on the lookout for it. Labels, of course, are a most essentially important thing, and it seems not

overcautious to say that some means should be taken to prevent their being destroyed by insect foes.

If labels should be dipped in an alcoholic solution of corrosive sublimate, it would doubtless render them perfectly safe from the attacks of Lepisma, and other insects as well. In poisoning dried plants to prevent the attack of insects, botanists use a solution of the strength of one ounce of corrosive sublimate to a quart of alcohol. The same, or a solution of double strength, would seem advisable for labels. If, after dipping, they are dried between sheets of blotting-paper under a weight, or in a letter-press, the labels will not curl, or be injured in any way. Corrosive sublimate, under the conditions of a cabinet, is a perfectly stable compound, and would retain its protecting-qualities for all time; whereas most insecticides have to be renewed occasionally, and would render themselves objectionable in one way or another by their presence. Labels may be treated with great rapidity if a large number are done at one time. Those already written on may be poisoned without affecting the ink; at least, such has been my experience.

Paper sized with lead might be proof against insects; and I have not seen any injuries done to labels sized with rosin, though a large number were in the cases where Lepisma committed its ravages.

Labels, after being written, could be coated over with water-glass (silicate of soda), which forms a hard, transparent glaze, and would surely be proof against insects; but it is objectionable, in that it takes a good deal of time to brush over each label after writing it, and, besides, the label curls somewhat in drying.

Professor Hagen has been told by ladies that their silk dresses, always black ones, had been destroyed by carpet-bugs, and has answered that they only attack wool, and has only lately learned that Lepisma did the damage. He also says that gold lettering on the backs of books, which is commonly done by putting gold on paste and burning it in, has been undermined by Lepisma.

When I first showed the labels to Prof. H. A. Hagen, seeking his advice, he was much puzzled, as he thought Lepisma could not have eaten them, and Anobium, the great library pest, does not like starch; in fact, he says it has been recommended to use such paste as is made of pure starch, in binding books, to avoid the latter.

Professor Hagen was much interested in this pest, new as such to him, and, looking up the literature of the subject, read a paper on it before the 'Thursday club.' Part of his delightful paper was published in the *Boston evening transcript* of March 13.

He very kindly wished me to write an account of what I had observed in regard to Lepisma, and to add from his manuscript the facts which he has gathered: they are contained in abstract in the following: —

Lepisma destructive to the labels is a true American insect, described by Professor Packard as L. domestica. There are half a dozen species in the United States. The principal one in Europe is L. saccharina, the small blue silver-fish. This insect is found in dark corners, and near provisions. In Europe it has always, but without proof, been considered as imported from America. It has been known there for over two hundred years; but its existence cannot be traced before the discovery of America. The whole of its flexible body is covered with fine irridescent scales which have been used as delicate microscopical tests; and to these hairs it owes its common name of silver-fish.

Nearly six years ago, at a meeting of librarians in Boston, Professor Hagen read a paper on library pests. After a review of the literature then at command, he concluded that only two North American insects were to be considered very dangerous to books, — the white ant; and Anobium, a small beetle which is also injurious to old furniture. These additions to his communication have been published; but they contain only isolated cases, certainly nothing of general importance.

The earliest notice of the small European species is in R. Hooker's 'Micrographia,' a folio published in London in 1665, and containing an account of innumerable things examined under the microscope. It is still respected for the accuracy of the author's statements. He figures Lepisma, and calls it bookworm, and says it corrodes and eats holes in the leaves and covers of books. On Mr. Hooker's authority, Lepisma was reported as injuring books; but as Mr. Hooker apparently confounded destruction done by Anobium with that of Lepisma, and since during the next hundred years no damages due to the latter were observed, the observation was doubted; and Professor Herman of Strasburg, in his prize essay on library pests, declared, in 1774, that Lepisma was erroneously recorded as injurious to books. For this reason, Professor Hagen did not mention Lepisma in his communication on library pests; the more so, as again in the next hundred years no new observations had been recorded.

Soon after his communication, new proofs of the depredations of Lepisma were observed. Professor Westwood of Oxford showed at the Naturalists' association in 1879 a framed and glazed print, in which the plain paper was eaten, while the parts covered with printing-ink were untouched. He mentioned that the same fact had been observed in India, where government records had been injured in a similar way. Patrick Brown says, in his 'Natural history of Jamaica,' that L. saccharina is very common there, and extremely destructive to books and woollen clothing. This statement was reproduced by Linnaeus, but was later considered as unreliable. M. de Rossi writes, in 1884, that L. saccharina likes damp places. It destroyed paper-hangings in his house, muslin curtains were perforated, and living animals found near the holes; also insect-boxes, and wings of butterflies, have been damaged. Professor Liversidge, in Sydney, reports the same year that L. saccharina is very common in New South Wales. He says it does not do much harm to books, as it cannot get in between the leaves, but injured loose papers, maps, and labels. The loose edges of piles or bundles of letters suffered more than the interior. The same calamity is reported by Mr. H. Lucas, assistant in the museum of the Jardin des Plantes in Paris. He says L. saccharina destroys labels of white paper, but parts printed on with minium and oil remained untouched. Labels of starched paper were much injured, but only the white parts. When leaving the country in 1862, he put in a drawer various articles of starched clothing, and, returning after six weeks, found numerous holes in it, and Lepisma near by. Dr. Aube, in Paris, says that the black part of the backs of books has been nearly destroyed, probably by Lepisma. The well-known antiquary, Mr. Quaritch of London,

complained in 1870 of injuries done to books by Lepisma; and Mr. Lewis, after careful examination, stated, that, on account of parts of the bindings having been eaten, the books fell to pieces. He considered it impossible for Lepisma to bore holes in the books, which holes were probably made by Anobium. Mr. Morrill, head master of the Boston Latin school, has sent books at different times to Professor Hagen, which were injured by Lepisma, and specimens of the obnoxious insect as well. Professor Packard, in his guide, speaks of silk being eaten by Lepisma, which also devours paste, making holes in the leaves of books. Also Mr. Horne of London alluded to the damage done to silk garments in India by Lepisma. The insect doubtless attacks the silk for the stiffening-matter in it, but nevertheless destroys the fabric. Finally Mr. Adkin showed a species of Lepisma which damaged account-books kept in an iron safe in London.

After all these reliable facts, there is no doubt that Lepisma may become very destructive to maps, engravings, photographs, herbariums, and other things, if left undisturbed. The question, why has it not been observed long ago? may be answered by the fact that they run so swiftly that they are easily overlooked.

If we tabulate all the facts, we find directly that all damages, excepting to paper, have been inflicted on clothing, muslin curtains, etc., which were invariably starched, or finished with some stiffening size. I found a set of labels in the museum which had apparently been eaten by Lepisma, but which, on most careful tests being made, proved to contain no starch.

Lepisma is easily destroyed by insect-powder, which kills all that it reaches; and Professor Hagen recommends the same to be sprinkled about silk dresses, or the drawers and closets where such articles, or others likely to be attacked by Lepisma, are kept. He would cover the backs of valuable framed engravings with common, unsized paper, fastened with a paste mixed with insect-powder. All papers, where pressed closely together, are not reached by Lepisma, and in this way large numbers of accidents may be avoided; or, if they would be injured by pressure, they will be safe kept in simple pasteboard boxes, made to close perfectly, so that the little pest could not find an entrance.

ROBERT T. JACKSON.

[This obliteration of labels by insects, presumably by species of Lepisma, has long been a source of annoyance in the paleontological department of the Yale college museum. To remedy the evil, the labels have been, for some time past, prepared by soaking in a solution of corrosive sublimate or arseniate of potash.—ED.]

Evolution and the faith.

It seems almost a pity that a magazine with the splendid reputation that the *Century* possesses for the encouragement it has given in past years to our contemporaneous expounders of modern thought, should admit to its columns such a contribution as the one that appears in the May number, from Mr. T. T. Munger, bearing the above title.

Mr. Munger closes the essay in question by indicating "in a categorical way the lines upon which further study should be pursued" with respect to evolution.

The several lines laid down in this category are divided into two sections, which are, 1°, "the respects in which evolution, as a necessary process in natural and brute worlds, does not wholly apply to man;" and, 2°, the "contrasting phenomena of evolution under necessity, and evolution under freedom." The first section indicates ten lines for further research into the laws involved; and the second, six. It would occupy far too much space here to reproduce all of these in the words of our author; and especially is this unnecessary, as it is my sole object to endeavor to show the general fallacy that pervades them all.

It must be evident to every one of us that Mr. Munger's chief error lies in the fact, that, in drawing up these 'further lines for research,' he has kept only before his eyes an idealized man and an idealized brute. May I ask our author where that hard and fast line is to be drawn, where 'instinct yields to conscious intelligence'?

A good many years ago I availed myself of the opportunity extended to me on a number of occasions, to examine that mass of living humans which constituted a cargo that filled the hold of a slave ship in the West Indies; and many a time since have I had the privilege of studying some of the lowest types of the now-existing Indians in this country. If Mr. Munger has ever had the opportunities of observing the habits of such creatures in their native haunts, I doubt very much that he would be wholly prepared to say, that, among *all species of men*, "the struggle for existence [now] yields to a moral law of preservation, and is so reversed."

Are our researches to now cease with respect to these low types of brute-like men, of which whole races still inhabit various quarters of the globe? Take the Mojaves of this country, and some of the tribes of central Africa, or Asia, or the native Australians, and any number of examples from them will stand witness to violate nearly every axiom Mr. Munger lays down in his category in the *Century*. In reality, some of them fully carry out the popular notion of a 'connecting link;' and from a study of their physical and moral organizations, science, no doubt, has derived some of her most trustworthy data for the establishment of evolutionary laws. They have by no means 'become conscious of the Infinite One,' nor do they 'systematize knowledge and reason upon it;' or at least, as Mr. Munger says for the brute, 'except in a rudimentary and forecasting way.'

Perhaps the remaining 'lines for research' of our author's category, upon which I have no comment to pass, may be more pertinent to a far later stage of man's development than would hold good at this day. The laws of evolution are still in active operation about us on every hand, and they have by no means been suspended in man's case, as Mr. Munger would have us believe. It can be said of the highest and best types of men, that, as a class, they are but on the threshold of psychical and intellectual evolvement, while some of the lowest forms of the black men of Africa occupy a moral and mental plane but a few degrees above the one in which we find the corresponding attributes of some of those representatives of the animal kingdom that no doubt, in our author's zoölogy, would be classified among the brutes.

R. W. SHUFELDT.

Fort Wingate, N. Mex., May 18.

Errata.

In these days of co-operative enterprises there is a chance of success for many a useful scheme that in other times would be utopian; and so the writer would like to suggest the usefulness of a separate systematic publication devoted to errata, to appear at intervals as materials accumulated for it. In it any student of an important book might hope to find collected all the important errors that critics and other readers had discovered. These errors might be disturbing misprints, slips in dates or the spelling of a name, mistakes in formulae or mathematical tables, etc., or possibly might extend to very brief criticisms on a book for the omission of very important facts bearing on the argument, or the use of unreliable authorities. Just how far it would be safe or desirable to go into such criticism, must, of course, be left to the judgment of the editor.

If such a plan commends itself to those who use books, and therefore want them to be correct, it ought not to be difficult to put it into operation through the co-operative work of public-spirited publishers, and of the librarians, who have already done so much for book-users, that in our gratitude to them we have the proverbial 'lively sense of favors to come.'

If the publication of such a list as this were started, either as an independent venture or as a supplement to the *Publishers' weekly* or the *Library journal*, we cannot doubt that many readers all over the country would gladly furnish contributions to it; and such scattered corrections as one finds in newspaper reviews of a book would be collected in a way to be useful to all who use the book in question.

C. K. WEAD.

Popular astronomy.

Permit me to make a few remarks on the review of my 'Story of the heavens,' which appeared in your issue of April 23.

You first charge me with appropriating a figure on p. 78 of Professor Newcomb's 'Popular astronomy,' and you assert that the text relating thereto has been borrowed from him. I refer to my 'London science class-book of astronomy,' articles 60 to 63, where essentially the same figures and reasoning are used. This was published in 1877; Newcomb's, in 1878. No doubt I had read Newcomb afterwards, and possibly improved on the original illustration by so doing. Probably the same idea has occurred to many others besides Newcomb and myself.

You also charge me with taking illustrations without acknowledgment, yet out of one hundred and six figures you only cite one (p. 228) to support the charge. The extent of my offence is just this: in the original manuscript of my book I had referred to Newcomb, but I struck out the reference from the proof in the belief that he would not care to be cited for so trivial a matter.

The two passages from Professor Young's 'Sun' have been unconsciously adopted by me by a carelessness which I sincerely regret. They were copied some years ago for use in my lectures; they passed into my manuscripts, and I lost sight of their origin, and treated them as my own language, which, until my attention was called to the matter by your review, I believed them to be.

While I am glad to have my errors pointed out, and to make what reparation may be possible, I must indignantly protest against the tone of your comments. You have fastened the worst construction on these blots, and accuse me of pillage. The simplest principles of justice should have required you to hear my explanation before you make so serious an allegation. You have even spoken of it as wholesale pillage, with what justice I leave your readers to decide. I have added the lines in the passages impugned in your review, as well as in the kindred review in the *Nation;* I have also added the equivalent of the illustration on p. 228; and I find the whole amounts to two pages and a half, while the entire volume contains five hundred and fifty-one. ROBERT S. BALL.

Dublin, May 12.

[We are glad to publish Professor Ball's reply to the critics of his book, and hope that he will feel fully vindicated by the letters from Professors Newcomb and Young in *Science* of April 30. — ED.]

Barometer exposure.

You gave a place to my letter showing how thermometers were affected by the place of exposure: will you now allow me to point out how the barometer also seems to be thus affected?

At the Blue Hill observatory, during high winds, the barograph shows sudden small oscillations, which, on watching, have been found to be coincident with changes in the wind's velocity. When the wind rushes by with increased velocity, the barograph sinks; and when the wind subsides somewhat, the barograph rises again slightly. About noon on March 16 the wind's velocity rapidly rose from five to thirty-five miles, and the barometer suddenly fell five-hundredths of an inch. During a sudden gust attending a shower last summer, the barometer fell a tenth of an inch, and immediately rose again as the gust ended. These facts all suggest that the wind, in blowing by at right angles to the cracks and crevices in the building, produces a mechanical effect, which tends to draw the air out of the building, and decrease the pressure inside. In confirmation of this conclusion, whenever, during high winds, the hatchway in the top of the tower is opened, it gives a larger aperture for the wind to act on, and the pressure on the inside immediately falls. It fell as much as a tenth of an inch during a seventy-mile wind in February. This seems to point to the conclusion that during high winds the barometer reads too low.

In Loomis's fifteenth paper in the *American journal of arts and sciences*, he discusses the reduction to sea-level of the barometer-readings on Mount Washington, and finds a number of cases in which the barometer readings, when reduced to sea-level by the formulas usually in use, are three-tenths of an inch or more lower than would seem to be the true readings as determined from the neighboring stations of Burlington and Portland. These cases all occurred when the wind was very high on Mount Washington, the average being sixty-six miles per hour, and some cases showing as much as a hundred miles. In his remarks, Loomis says that these "great anomalies are confined to the colder months of the year, and seldom occur except during the progress of violent storms."

This suggests that at Mount Washington, as at Blue Hill, and probably elsewhere, the wind, in blowing by the building with great velocities, produces a partial vacuum inside. H. HELM CLAYTON.

Blue Hill observatory, May 18.

SCIENCE.—SUPPLEMENT.

FRIDAY, MAY 28, 1886.

THE STATE AS AN ECONOMIC FACTOR.

I.

THERE is no more significant difference between what, for lack of better terms, we may call the old and the new schools of political economy than their respective attitudes toward the state. The old school, in which I would include Adam Smith and his best-known English followers, culminating in the so-called orthodox economists, derived their ideas in regard to the nature and functions of the state from the views of the writers on jural and political science which prevailed in the latter half of the last century. They have almost universally accepted these conceptions of the state as fully satisfactory for the uses of the economist, without any real attempt at an analysis of the functions of the state from the economic side. It is hardly necessary to say that these ideas have long since been repudiated by the cultivators of the jural and politico-philosophical sciences as entirely unsatisfactory. But the orthodox economist has held to them as if they were law and gospel. We have, as a consequence, the rather absurd phenomenon of the cultivators of one science holding to the conceptions taken from another which the latter itself rejects as worthless for all scientific purposes.

The new school, on the contrary, has simply adapted itself to the changed conditions, and accepted the results of scientific progress in neighboring fields, and on this as a foundation has undertaken to carry the science another stage forward in its development. It has indeed contributed something to jural philosophy itself by its attempts to analyze the concept of the state from the economic side, in order to ascertain the function which it performs in the process of economic production and distribution.

Adam Smith, in common with the tendencies of his time in the field of political and jural speculation, looked upon the state as a purely negative factor in economic and social life, — a something which grew out of the defects of men, — a necessary evil which did most good when it did least harm. He considered its functions to be simply those of protecting society against aggression from without, and violence within. He saw in individual action the source of all progress, the hope of all civilization, and held that the race would move forward in proportion as all government trammels were removed from individual activity. I do not mean to say, of course, that Smith was consistent in this view, because consistency in such a view is simply impossible, and has never been achieved by any great thinker. He was compelled to disregard his theory repeatedly when discussing practical questions of government and politics of his own time, and many passages may be quoted from his works to prove that he tacitly repudiated the whole doctrine. In this respect he resembles very much some of his distinguished followers, who, finding it impossible to be consistent and to bring their theories into harmony with the hard facts of the actual world about them, make all manner of practical concessions inconsistent with their fundamental principle, which may be quoted to prove that they did not hold such doctrines at all.

But no one can read Smith carefully without admitting that his theory of the state practically denies to the latter any economic function whatever, beyond the simple one of keeping order within its boundaries. All that is more than this cometh of and leadeth to evil. Certain it is that all those in this century who have been opposed to state action of any kind have appealed to the authority of Smith and certain of his followers as having established beyond a doubt that the state has no business to interfere with economic or social relations.

As a matter of fact, Smith made successful war upon certain forms of governmental interference, which in his time were undoubtedly doing great harm; but instead of being content with showing that those particular restrictions had outlived their usefulness, and that the time had come when they could be better dispensed with, he tried to show, or rather assumed, that such restrictions were *per se* injurious, and could be productive of evil only.

The investigation of historians in this century has proven conclusively that the state, so far from being the source of innumerable evils, has always been not only the absolutely essential condition of human progress, but also one of the most important, if not, indeed, the most important, factor in the economic evolution of society itself. It proved that no economic progress has ever taken place outside of the state, and very little indeed within it, except on the basis of the active sup-

port and co-operation of the latter. It established the fact that in state initiative, indeed, lay oftentimes the only hope of any economic development. It demonstrated that many of the very institutions which Adam Smith and his followers so vigorously and successfully assailed had in their own time done the most valuable service in initiating and furthering economic progress. In a word, it dealt a death-blow to that conception of the nature and origin of the state which played so large a *rôle* in the political speculations of English, French, and German philosophers of the last century by showing conclusively that nothing corresponding to their premises had ever actually existed in human history, and that state action, not merely of a restraining but also of a fostering and furthering kind, has always been the condition and concomitant of any considerable economic development.

The conclusions of history, sufficient of themselves to destroy the old theory, are amply sustained by a careful analysis of the process of production and distribution in our modern society. If we analyze any of the most ordinary acts of production, we shall find that the state is actually or potentially present at every stage of the process. Take, for example, the business of making cloth. The manufacturer could not hope to make any considerable amount of cloth if the state did not protect him in his work by the force of its courts and armies. He could make but a very small quantity, indeed, without the aid of inventions, the preservation and transmittance of which, nay, their very existence itself, is only possible within and through and by the state. Having produced his cloth, he would have no right worth the name to its ownership, if the state did not define and enforce his rights as against all other parties within the state. Having produced it, and being acknowledged as the owner of it, it would be of no earthly value to him, except so much as he might wish to make use of for his own personal purposes, if the state did not protect him in his right to exchange it for the product of other labor toward which the state stands in exactly the same relation as it bears toward that which he produced. The value of his product depends almost entirely upon the means which the state has provided, in the form of roads and means of transportation and communication, to enable him to get to a place where he can exchange it. The value, moreover, depends largely on the general state of civilization within the country, which is to a very great extent determined by state activity. The enjoyments which he can extract from the products he may receive in exchange for his cloth will depend to a great extent on the education which he may have enjoyed, which, again, will be determined by the extent to which the state may have provided the necessary facilities. When we look, not merely at an individual act of production, but take in a wider view of the industry of the country as a whole, we shall see still more clearly the real character of the state as an economic factor. We see, for instance, in manufacturing, that the discovery and introduction of improvements, the provision of means of transportation, the general provision of educational facilities, both technical and general, — all necessary elements in any wide and long-continued successful system of industry, — have been nearly always chiefly furthered and promoted by state activity in some form or other. In other words, every great extension of the field of production has really been to a large degree dependent on state interference — not merely in a restraining, but also in a promoting and fostering way.

We may formulate our conclusion, then, somewhat as follows: the state is an economic factor of prime importance. To our modern system of production not only are natural agents, labor, and capital necessary, but also the particular kind of services which can be rendered only by the state. The nature of its service is just as fundamental to production as that of labor or capital, and it should be included among the requisites of production. It is a fundamental economic category, something which belongs to the very essence of production, and not something accidental and external, which may be lightly cast aside.

The particular function of the state in the sphere of economics is a varying one. It changes with time and place and circumstance. Perhaps the most general formulation of the essential characteristic of state action in this field is that it is preeminently a co-ordinating power. It is a special form of associative action. History shows that men as individuals do not live unto themselves. They must carry on the struggle for existence side by side within and through some kind of social organization, if they are to attain any higher level than the brutes. But no sooner do they appear within such an organization, than the absolute necessity of some type of co-ordinating power immediately appears. Individuals may and ordinarily do appropriate natural agents, and insist on utilizing them in such a way as to preclude any great economic advance; as, for instance, when men take possession of large tracts of land, and refuse to allow others to pass through them. In such a case, the necessity of a co-ordinating power immediately appears. The state, or what answers for that in the given condition of society, must open up roads, no matter what individuals may wish, if

economic development is even to begin. The lay of the land may be such that an extensive system of drainage may be indispensable in order to render it fit for cultivation. The whim or interest of individuals may, and where they are allowed free play usually do, prevent the inauguration and completion of any such work. Associative action may be, and ordinarily is, the only means of securing such an end. Voluntary associative action is generally precluded by the refusal of some individuals to take part whose co-operation is necessary to success. The only means left is compulsory associative action through and by the state. The time soon comes in a progressive society when, in order to secure a higher degree of efficiency, new crops, new kinds of live-stock, new inventions, are necessary; when a new organization of the labor of the country must be undertaken, as, for instance, the abolition of slavery or serfdom, or the development of a system of small farms, — all things which are just as necessary to an increased production as the application of more labor and capital, and all things which can be accomplished on a great scale only by the exercise of state power. Furthermore, a time comes when, in order to secure a larger production, the great mass of the people must be educated, and the skilled laborers necessary to the economic progress of a society must have facilities for acquiring a technical education. All recent history shows that the state must here interfere, and compel co-operative action on the part of its citizens, if the necessary facilities are to be obtained. To take another example, science and experience demonstrate, that in order to obtain the maximum of agricultural production, for instance, from a given country, it is necessary that a certain portion of the surface should be wooded. History shows us that there is no adequate economic motive for private individuals to preserve this proportion if it has once been established, or to establish it if it has never existed: hence the necessity for the state to interfere, and to secure by the application of compulsion the necessary conditions of progress. An excellent instance of this same thing is to be found in our modern railroad system. In order to secure the building and equipment of the railway, we have had to pay enormous sums, directly and indirectly, from the common treasury of society. The state, in all its various governmental forms, national and local, has contributed land, money, and legal powers and guaranties, without which our railways would have remained a comparatively insignificant element in our system of transportation. It has created fictitious persons for the ownership and management of the railways. It has given those fictitious persons not only immense sums of capital, but peculiar and ample privileges; among others that far-reaching and most significant attribution of sovereignty, — the right to take the property of real persons against their will, and give them, not what the owners consider it worth, but what it seems worth to parties who look upon it in the character of disinterested appraisers.

To sum up this phase of the subject in a few words: a community, on emerging from barbarism, and as it passes from one stage of civilization to another, finds, that, in order to secure a healthy economic progress, large quantities of capital and labor must be expended along lines where a few individuals, by their ignorance or obstinacy, may prevent that collective action without which such investment cannot be made. It is necessary for the state to interfere in such cases; and its action is as truly economic action as that which removes by a tunnel the obstruction presented to trade by a hill, or which renders commerce across a river easy by the construction of a bridge. This same community finds, moreover, that large quantities of capital and labor must be expended along lines where private individuals cannot be persuaded to invest it, since they can see no immediate and sufficient return to them personally. The state is in such cases the only hope; and if, by its incompleteness or weakness, it is unable to respond to this demand, progress stops and retrogression begins.

It is easy to see the bearing of this general view of the economic functions of the state. It establishes the primary importance of state action in economic progress, and it claims for it a purely economic character. So far from allowing that the presumption is always in favor of non-interference on the part of the state in economic matters, it claims that in whole classes of economic processes the presumption is strongly in favor of government interference; so strongly, indeed, that the mere fact of government non-interference proves that the community is living in a lower economic stage than is within the grasp of its collective action by state agencies. It vindicates for the collective action of the community, within and through and by the state, an economic function no whit less fundamental, no whit less important, and in many respects more far-reaching, than that hitherto accorded to individual action. It is an idle attempt to decide which is the more important of two factors both of which are absolutely necessary to the result. It is like trying to prove, that, of the two lines which form an angle, one is more necessary than the other. And yet this is what the old school attempted to do in belittling the economic

functions of the state. The new school simply desires to claim for them their proper position. It is undoubtedly true that in certain countries individual activity and initiative are not vigorous enough to work out the highest possible economic results; but it is also equally true, that, in other countries, state activity and initiative are not vigorous enough to secure the economic results which can only flow from collective action within and through and by the state.

The relation of this theory to the subject of taxation, for example, is significant. From this point of view, taxes are not rewards paid by the individual to government for the protection accorded by the latter. They are simply a share of the product which the state may rightfully claim as being one of the factors in the process of production. The state, as the representative of society, is the great 'silent partner' in every business enterprise. As compared with any given individual, it contributes the larger share of the means of production. To test the relative productivity of the state and the individual, compare the fortune accumulated by Cornelius Vanderbilt in America with what he might have accumulated had he been adopted when an infant by a family of Hottentots.

One word more as to the bearing of this theory on the future of the state as an economic factor. According to the old theory, the functions of the state will become fewer and fewer as society progresses, until finally it will do nothing, or at least nothing but protect, in the narrowest sense, life and property. According to the newer theory, as men become more numerous, the conditions of society more complicated, the solidarity of interests more complete, we shall find that the economic sphere of collective action as opposed to individual action is all the time widening. Hand in hand with this advance, we shall find that government will be so improved that the state can safely undertake to a larger and larger extent the exercise of this collective action. So far, then, from the interference of government decreasing with the improvement of men, we shall find that this very improvement renders it safe and desirable to increase the sphere of state activity. All this can be done without in any degree impairing individual activity of a desirable kind, and, indeed, with the result that the sphere of the latter may be continually widened.

To put the case in a little different way, there are, according to this view, in any given state of civilized society, certain classes of economic actions which can be best performed by a general system of co-operation embracing all the members of said society. To the efficiency of certain of these classes it is necessary to have complete co-operation, which, as all experience proves, is only possible through compulsion. The only form of desirable compulsion in such cases is state compulsion, which, of course, may be exercised in various ways — from compelling co-operation by courts and armies, to that of undertaking the business by government agencies. If such actions are left to private individuals, it just as surely results in economic injury to society, in circumscribing the field of employment, in discouraging and destroying individual enterprise in the widest and broadest view, as the assumption by the state of forms of economic activity, which should be left to private individuals, tends to destroy all spirit of enterprise in a body politic. When it appears, therefore, on analysis of a given case, that it is one which calls for compulsory collective action, it is not a satisfactory answer to say that the government is too defective in its organization to undertake such work, and therefore it must be left to individuals, since this simply means that it will not be done at all. For certain economic ends the only efficient agency is state agency; and, if that is not available, the only result can be failure to reach those ends. In case of defective government, then, our course is not to rest content with remanding government functions to private individuals, but to improve government until it is adequate to the legitimate demands; and one of the most effective means of improving government is to insist that it shall undertake its proper functions, since the consequent importance of its work will render imperative its re-organization on a proper basis.

E. J. JAMES.

II.

1. Professor James says much of the old school and the new school of political economy. Yet the differences between the schools, so far as he mentions them, are not on strictly economic matters. He discusses the nature and function of the state, and raises very wide and difficult questions. These questions economic science does not answer and should not pretend to answer. It merely helps to answer them, by investigating one aspect of man's activity. Economists have often expressed themselves on the general subject of the sphere of government; but in so doing they have spoken, not as economists, but as speculators on the theory of the state and of society at large. Adam Smith no doubt said a good deal about the proper limits of government action. Yet his conclusions on that subject formed no essential part of his economic doctrines. So, in the first half of this century the followers of Ricardo frequently gave

expression to a certain conception of the state, which is indicated by the phrase *laissez faire*. They sometimes went so far as to treat *laissez faire* as a natural law, nay, as a natural law of political economy. It was a great mistake to treat it as a natural law; at most, the phrase indicates only a rough rule of thumb. It was a still greater mistake to treat it as a law of political economy. Political economy investigates and explains the phenomena of wealth; in doing so, it helps the 'jural and politico-philosophical' thinker (to use Professor James's comprehensive expression) in solving his general problem as to what the state should do. But economic science does not pretend to solve it, by laying down a rule of *laissez faire* or one of state interference. In laying down a rule as to state interference, the new school is not a new school of political economy, but a new school as to something else. Its adherents commit the same mistake, as it seems to me, that was committed in former days by the adherents of the *laissez faire* ideas, whom they attack so sharply. They fail to distinguish between the province of economic science, and that of sociology, or social science, or political science, or whatever the general science be called.

2. No economist has denied that the state is a most important factor in industrial matters. The economist says, given such and such a condition of the laws and of the government, what effect on the phenomena of wealth can be traced? Obviously the character of the government, and the extent to which it maintains peace and order, enforces contracts, and protects property, are of the utmost economic importance. Professor James's lucid exposition of the cloth-manufacturer's situation is hardly needed to prove this. But thereby he does not succeed in showing that the government should become a still more important factor, or a factor of an essentially different kind. Possibly it should; but to establish this, it is not a valid argument to adduce the unquestioned fact that the activity of the state is at present one important cause among a large number that bring about economic phenomena. In the eighteenth century, government interfered multifariously and vexatiously in industrial matters; yet surely that fact in itself did not go to prove that it should interfere still more.

3. It is a very sweeping statement that "every great extension of the field of production has been to a large degree dependent on state interference, not merely in a restraining but in a fostering and promoting way." That raises a question of fact, of economic history, on which I must beg to differ with Professor James. His statement seems to me exaggerated, and in essentials incorrect. The economic history of the last hundred and fifty years does not support it. The enormous advance in the arts during the past century seems to me to have been singularly independent of state interference. Certainly it has not been the result of any extension of government activity over and above that degree of activity which was common in the preceding period. The state tried to foster and promote in the seventeenth and eighteenth centuries much more than it has done in our time; yet we have seen a striking enlargement of the field of production. If economists of the old school belittled the importance of the state, those of the new school are in danger of succumbing to a temptation to exaggerate it.

4. As to the main question, namely, the attitude we should take to the question of state interference in industry, Professor James states his belief that the presumption is strongly in favor of interference 'in whole classes of economic processes.' It is not clear to me how much he includes in this phrase. No doubt there is a tendency toward a degree of regulation in some branches of industry, of which railroads and telegraphs are prominent examples. Economic study gives certain data on such questions; for instance, by showing the advantages of single management, and the supplanting of competition by combination. The data given by economic study, together with those given by study from other points of view, lead us to believe that, as matters stand now, the community should regulate these industries more than it does cotton-spinning and bread-making. How far it should go in its interference is a practical question, to be settled for each case slowly, cautiously, tentatively. In comparatively simple cases, like water-supply, complete ownership by the public has come to be the general rule. The time has perhaps come to handle gas-supply in the same way. How far we will go or should go in a complicated problem like that of railroads, no man can tell. Certainly it is premature to lay down a general rule or presumption in favor of state ownership or management. That new theory which tries to lay down as some sort of a law, or at all events as a certainty for the future, a steady and continued enlargement of the sphere of state activity, rests as yet on a very slender basis of experience. In any case, it is not a new economic theory, but a wide speculation in sociology.

Very little seems to me to be gained by advancing, for problems of this kind, general speculations about collective action and the sphere of the state. Certainly there is no occasion in this country to stimulate the tendency in favor of state interference. There is already quite a sufficient general inclination to interfere. Not infre-

quently, to be sure, one hears expressions about natural freedom and non-interference with the natural laws of trade; expressions which are survivals of the exaggerated *laissez faire* tinge of a generation ago. But no feeling of this kind operates as an effectual barrier to state interference, or stands in the way of needed reforms. On the contrary, public men and voters alike are over-ready to jump at schemes for state regulation, and to engage in crude and harmful and impracticable legislation. Witness the passage in the house of representatives of a bill like the Reagan interstate-commerce bill, — fortunately replaced in the senate by the more moderate, though still far-reaching, bill just passed by that body. In face of the rash attempts of which the Reagan bill is a type, economists and students can most usefully approach the problems, not by general encouragement of state regulation, but by the careful and unbiassed study of specific questions. F. W. TAUSSIG.

III.

IN his criticism of my views, Professor Taussig takes the old ground that economic science has nothing to do with the functions of the state. This is exactly the point at issue, and could not, perhaps, be better put than it is by Professor Taussig. I hold that the science of political economy must consider the *economic* functions (notice the limitation) of the state in order to afford any satisfactory explanation of the phenomena of wealth in modern society. It would undoubtedly be possible to construct a science of an economy in which capital, for example, played only an insignificant part; but such a science would have no sort of relation to modern, social, or political life. A science of wealth which leaves out of its treatment the economic functions of that co-ordinating power which in its highest form we call the state, is almost as far removed from any vital connection with our present or future needs.

This is undoubtedly the real reason why all the great thinkers in the field of economics have as a matter of fact, in spite of their protestations that it had nothing to do with the subject, given such a large share of attention to the functions of the state. Adam Smith's views of state action are not an unessential feature of his economic theories. They form part and parcel of them, and cannot be extracted without shaking to its foundations the edifice into which they are built as constituent parts.

The scientific advantage of the view for which I am contending, over that represented by Professor Taussig, consists, as I conceive it, in this. If we recognize the fundamental economic character of state action, we have a simple, plain, scientific basis for examining the relations of state action to other forms of economic activity. It enables us to investigate within the limits of our economic system whole classes of economic facts connected with state action, which, however much we may wish to disregard them, will force themselves on our attention, and if not treated in an open and scientific manner, and assigned to their proper place, must be disposed of in a half surreptitious and unscientific way. This point of view enables us to bring state action, *so far as it is economic in its nature*, into organic relation with other economic forces in our scientific system, and by an analysis of the processes of production, distribution, and consumption of wealth, to assign to each factor that sphere of action which, with a due regard to existing economic conditions, shall work out the best economic result. This theory is, in my opinion, a progressive one. It contains the promise and potency of life.

The other, on the contrary, is the opposite of this in the respects just enumerated. And so far as any thinker maintains it, and is still doing progressive and active work in the field of economics, — and no better example of this class can be quoted than Professor Taussig himself, — he is continually, as it appears to me, violating his own fundamental principle, and working at a scientific disadvantage.

It will be noticed that this view in itself does not call for any extension or limitation of state action. It simply maintains that there is a sphere of economic activity in which state action is by far the best, if not the only, means of reaching satisfactory results. It holds that this state action is as truly economic as that of individuals, and that it should therefore be regarded as a fundamental economic category. The exact limits of this sphere — the exact things to be done by the state — vary with time and place and circumstance. It may therefore very well be, that two persons holding these different views might agree as to what state action, in an economic direction, is desirable, for instance, at this time in our own country. The difference, as it seems to me, would be simply that the views of the one in regard to state interference would form a consistent part of that one's general economic system, while those of the other would be more or less adventitious. It is the former class of views which promote the development of a science.

I desire, in closing, to express my dissent from Professor Taussig's opinion that the enormous advance in the arts during the past century has been singularly independent of state interference. To argue this point of difference would require a

long chapter of economic history. I think the statement on this point in the body of my article is essentially true. Nor can I agree with my critic that we do not need to stimulate the tendency in this country in favor of state interference. I think that we are prevented to-day from undertaking certain great reforms by the general feeling in the community at large that individual instead of state effort should be relied upon in all cases to secure economic advance. To present the conclusion of the matter in a word, it is perfectly possible, of course, for the state to interfere in such a way as to discourage and destroy industry. All of us agree to that. It is, on the other hand, we claim, perfectly possible for the state to interfere in such a way as to promote and create industry—nay, more: it must be continually interfering to do this, otherwise progress would stop and retrogression set in. Such action is economic in character, and the systematic investigation and discussion of it find their proper place in the science of economics.

E. J. JAMES.

CLIMATE AND COSMOLOGY.

No one should take up Mr. Croll's essays for light reading; not because his writing is not sufficiently clear and concise, but because the interaction of the many direct and indirect causes concerned in his physical theory of terrestrial climate requires so involved a conception that the reader must go slowly to possess himself of it fully. This is shown by Mr. Croll's frequent and just complaint that his critics fail to apprehend his points.

The essence of his argument is, that, during a time of great eccentricity of the earth's orbit, the hemisphere, having its winter in aphelion, will be subjected to glacial conditions as a result of the various physical processes then brought into play. Prominent among these is the diversion of the warm equatorial ocean-currents into the non-glaciated hemisphere by means of the increased velocity of the trade-winds in the glaciated hemisphere, and their extension well across the equator, on account of the then great difference between polar and equatorial temperatures on which they depend. For example: if our hemisphere be the cold one, it is supposed that the north-east trade would gain in strength, and extend south of the equator, so far as to carry all the equatorial currents into the southern hemisphere. "The warm water being thus wholly withdrawn from the northern hemisphere, its temperature sinks enormously, and snow begins to accumulate in temperate regions."

Discussions on climate and cosmology. By A. CROLL. New York, *Appleton*, 1886. 12°.

If this fundamental point be conceded, we may as well grant all that follows it; but it cannot be conceded for a moment. Our north-east trade will doubtless be strengthened, in winter at least; but so will the prevailing westerly winds of our temperate latitudes. Moreover, the heat equator, along which the trade-winds meet, will not migrate far south from the geographic equator, on a planet with as short a year, as moderately inclined an axis, and as large an equatorial water-surface, as ours — especially when the southern summer is moderated by coming in aphelion, and again, especially in the Atlantic, as long as the coast-line of Africa allows so much cool South Atlantic water to reach the central torrid zone, and as long as Cape San Roque stands in the way and turns so much of the equatorial current northward.

No sufficient reason, therefore, appears for granting the north-east trade strength and area enough at such a time to keep warm water out of the North Atlantic, summer and winter; and in this ocean, at least, the general eddy-circulation would be continued much in its present form, all the more because whatever aid is given by gravity to the wind-made currents is then intensified. The broad drift of waters that crosses the North Atlantic from our shores to Europe would then be accelerated by the stronger winter winds; it would then, as now, divide opposite Spain; and the northern branch on which the moderate temperature of north-western Europe so largely depends would then, as now, be supplied largely with water that had been warmed while crossing the equator. As long as this source of warmth prevails, a winter's snows in far aphelion cannot overreach the succeeding summer's melting in close perihelion, without the assistance of geographic or other changes which Mr. Croll deems unessential.

In view of such objections as this, it seems to me that Mr. Croll decidedly overstates the security of his position in saying that his theory contains 'no hypothetical elements.' The quantitative estimation of his causes is certainly often hypothetical. Until more is known, not only about winds and currents, but also about the behavior of the atmosphere towards radiant energy, and the part played by dust over the land (of which Mr. Croll takes practically no account) as well as by vapor over the ocean, there must naturally be much of hypothesis in the discussion of terrestrial temperatures.

Readers of Dr. Croll's work should examine also a *critique* by Woeikof in a recent number of the *American journal of science.*

W. M. DAVIS.

MANUAL TRAINING.

IN the wave of enthusiasm for manual training which is now passing over this land, it is very difficult to get together the results of experience, and still more difficult to determine whether the plans which work well in one place are adapted to another. Therefore every honest record of a working organization is to be welcomed. Even when the opinions of a writer are not accepted, his statement of facts should receive attention.

These remarks apply to the volume on manual training, which has lately been published from the pen of Charles H. Ham. The work has its practical, its historical, and its philosophical aspect. In the first hundred pages there is an elaborate account of the Chicago manual training school, which was founded in 1883 by the Commercial club, — an association of merchants, who, after a discussion of 'How to increase the supply of skilled labor,' pledged the sum of one hundred thousand dollars for the support of an industrial school. A large building has been constructed, and instruction is given in carpentry, wood-turning, founding, forging, and in the making of machinery. The various laboratories devoted to these purposes are described, but the experience of two years is, of course, too limited to be very significant. The general principles of the establishment seem to be in close accordance with the well-known views of Professor Runkle of Boston, and of Professor Woodward of St. Louis.

In reading this volume we have been impressed with this danger, — that, in giving emphasis to the value of manual training, the worth of mental training will be overlooked. James Russell Lowell, in a recent speech, wittily said that not only are those studies of value which make bread-winning easier, but also those which will make every morsel of bread taste the sweeter.

The author of the book before us declares at the beginning that it is a theory of the Chicago school, that "in the processes of education the idea should never be isolated from the object it represents." Indeed! Can this be so? Are 'abstractions' to have no rights which the school is bound to respect? How about the idea of number, of form, of quantity, of force? Probably the author did not see the bearing of his remark; but he repeats it in these words: "Separated from its object, the idea is unreal, a phantom." This is very different from the saying of Sir Humphry Davy, that there is nothing so prolific in abilities as abstractions. Believing as we do in the great importance of manual training, believing that every living being will be happier if he can skilfully use his fingers in some useful art, we regret to see the advocates of dexterity defend their views by wrong arguments and defective logic.

Manual training, the solution of social and industrial problems. By CHARLES H. HAM. New York, *Harper*, 1886. 12°.

THE Johns Hopkins university circular for May states that Professor Rodolfo Lanciani of Rome will give a course of lectures on Roman archeology during the next academic year. He has been for some years professor of archeology at the Roman university, and inspector of excavations for the city, and is also one of the leading members of the archeological commission of Rome, and of the Pontifical archeological society. Though still quite young, he is one of the first authorities on Roman archeology, and has followed with greater care than any other archeologist the important excavations that have laid bare, from 1871 to 1886, so considerable a part of the ancient city. In 1880 he published "I comentarii di Frontino intorno le acque e gli aquedotti. Sylloge epigrafica aquaria," a learned work crowned by the Academy of the Lincei. This is but a small part of a great work to which he has been devoting years of research, — a complete topography of the ancient city of Rome, critical and historical. Professor Lanciani has contributed important papers to the *Bull. della comm. archeologica*, to the *Notizie degli Scavi*, and other archeological periodicals, besides separate works, such as 'Iscrizioni dell'Anfiteatro Flavio' (1880).

— The recent invention by Dr. J. O'Dwyer of New York, of a new method of treatment to take the place of the dreaded recourse to tracheotomy in diphtheria and membranous croup, bids fair to be of the greatest importance. His method does away with cutting-instruments entirely, and consists simply in the insertion of a tube of peculiar shape between the vocal cords, thus permitting the ingress of air into the trachea. The results already reached by this intubation treatment compare very favorably with those from tracheotomy, as regards the saving of life; and if, on extended trial, they are borne out, the invention will be ranked with the more important ones of the century, in medicine.

— Mr. S. Hertzenstein of the Zoölogical museum of the Academy of sciences, St. Petersburg, Russia, is endeavoring to prepare schemes for public museums in Russia, to be promoted by the authorities. He would be grateful for any reports of American museums, especially such as relate to their organization rules or plan of operations. Any such may be mailed to him direct, or may be addressed to him, under cover, to the Smithsonian institution, Washington.

SCIENCE.

FRIDAY, JUNE 4, 1886.

COMMENT AND CRITICISM.

IN A RECENT NUMBER of the *Revue internationale de l'enseignement*, M. Breal, who has written before on educational topics, has an essay on the methods of acquiring foreign languages. Among some old considerations of value, he adds the less well-known remark, that, when a person goes to a foreign country to 'learn the language,' he rarely succeeds. But if he goes to pursue some definite profession or business, — M. Breal suggests banking at Frankfort, the book-trade at Leipzig, and brewing at Munich, among others, — then he acquires the language very rapidly as well as very thoroughly. The reason for this is plain enough: it is the substitution of natural for scholastic methods. And nature, being the better teacher, comes out ahead. In the former case, dictionaries and grammars figure largely; while, in following M. Breal's suggestions, the phrases of ordinary conversation, as well as the terminology of some particular calling, become part of the student's daily experience from the first. The hint is a valuable one, and it might save time and money, to say nothing of a discouraged spirit, to the numerous young men and women who go to Germany, France, and Italy each year to 'learn the language.'

IN THE DEATH, on May 16, of the aged German historian, the world has lost a scholar who has done as much as, if not more than, any one else for the extension of scientific method, and for the application to history of those rules and tests which mark the nineteenth century as pre-eminently the era of science. Born in 1795, when the reign of terror was hardly passed, and when the metaphysical notions as to the theory of the state and the rights of man which had been formulated by Bodin, Grotius, Montesquieu, Voltaire, and Rousseau, were finding their logical outcome in anarchy, Ranke grew up in a period of transition. The wave of constitutionalism was gathering a force to which even the reaction from the revolutionary excesses of the commune, aided by the holy alliance, could be but a temporary check. With a genius that detected the chain of causation amid a complicated mass of detail, with an exactness and an accuracy that made even the smallest event of importance, and with a power of lucid, graphic statement which attracted and interested while it instructed, Ranke was born a scientific historian. He appreciated to the full the meaning of the contemporary development, but with true historical instinct he turned to the elucidation of that previous period of transition from feudalism to absolutism which is the key to the history of western Europe in the fifteenth, sixteenth, and seventeenth centuries. In this field he was the acknowledged master. In addition to his own magnificent labors, we owe to Von Ranke the *seminarium*, that peculiarly scientific department of university work. And it is from him that Waitz, Giesebrecht, Von Sybel, George Bancroft, and a host of lesser historians have drawn their inspirations.

FABRY'S AND BARNARD'S COMETS, the two that have been with us since last December, have now disappeared from view in the northern hemisphere. Very few astronomers appear to have seen these comets under the most favorable circumstances. Mr. T. W. Backhouse, however, reports that on April 26 he followed the tail of Fabry's comet to a distance of thirty-eight degrees; and Barnard's comet he found on May 1 had two tails, the principal one four and a half degrees in length. To replace these comets we have three new ones discovered by Mr. Brooks, on April 27 and 30, and May 22, respectively. They are all fairly bright for what are called 'telescopic' comets. The calculated elements show that the first reaches its nearest point to the sun on June 6, and is increasing slightly in brightness: the second comet is decreasing in brightness, having passed its perihelion on May 4.

HEALTH OF NEW YORK DURING APRIL.

THE total population of New York on April 1 was estimated at 1,428,898, and is believed to be increasing at the weekly rate of 799.

The total number of deaths from all causes was 2,965, or about 99 each day. Comparing this with

the same number of days in March, there was a reduction representing the saving of 290 lives, and this not taking into account an increase in the population of more than 3,000 souls.

In March the largest number of persons succumbed to disease on the 31st, there being on that day 137 deaths recorded; on the 30th of April the maximum limit was reached, amounting to but 124 deaths.

The deaths of children under five years of age during March were 1,221, and in April but 1,075; and yet diarrhoeal diseases carried off in April 56 persons, and only 32 in the preceding month. Scarlet-fever caused a mortality of 49 this month, as compared with 42 in March. The lines in the chart representing scarlet-fever and the diarrhoeal diseases, which for two months have nearly coincided, now begin to diverge, and the separation will be more and more marked as the season advances. The increase of deaths from diarrhoeal diseases appears to be pretty evenly distributed throughout the month, and not very perceptibly increased in any one period over another. The largest number of deaths from diseases of this nature in any one day was 5, on the 22d. The week in which this occurred was characterized by high temperatures, 81°, 74°, 74°, 81°, 84°, and 83° being the maxima for six consecutive days beginning with the 19th; and during this period there were 16 deaths from this class. The next largest number of deaths was 4, on the 11th inst.; and on six consecutive days of that week the maxima reached by the thermometer were respectively 70°, 52°, 64°, 68°, 69°, and 67°, and the recorded deaths were 14.

This is an interesting comparison, and would seem to show that there are other influences at work in the causation of diarrhoeal diseases than an elevation of temperature at one part of the day. On these days, when the thermometer was ranging from 74° to 84° in the afternoon, it was at other parts of the day much lower, sometimes as low as 48°. It is the high temperature continued throughout the greater part of the twenty-four hours, and repeated day after day, as occurs in July and August, which produces such fearful ravages among the inhabitants of the large cities. Especially is this destructive influence marked when the air is laden with moisture. A study of the accompanying chart will show, that, at the time when these high temperatures occurred, the air was comparatively dry; on the 23d inst., when the maximum temperature was 84°, the humidity was but 60, saturation being 100. That this is an important element in the problem is not to be overlooked. It is a matter of common experience that a temperature of 90° with a dry atmosphere can be more comfortably borne than one of 80° with the air saturated with moisture. In the one case evaporation from the body is rapid, resulting in a cooling of the surface; in the other it is impeded, or seriously interfered with.

Consumption and diphtheria show for April, as compared with March, a slight decrease in mortality.

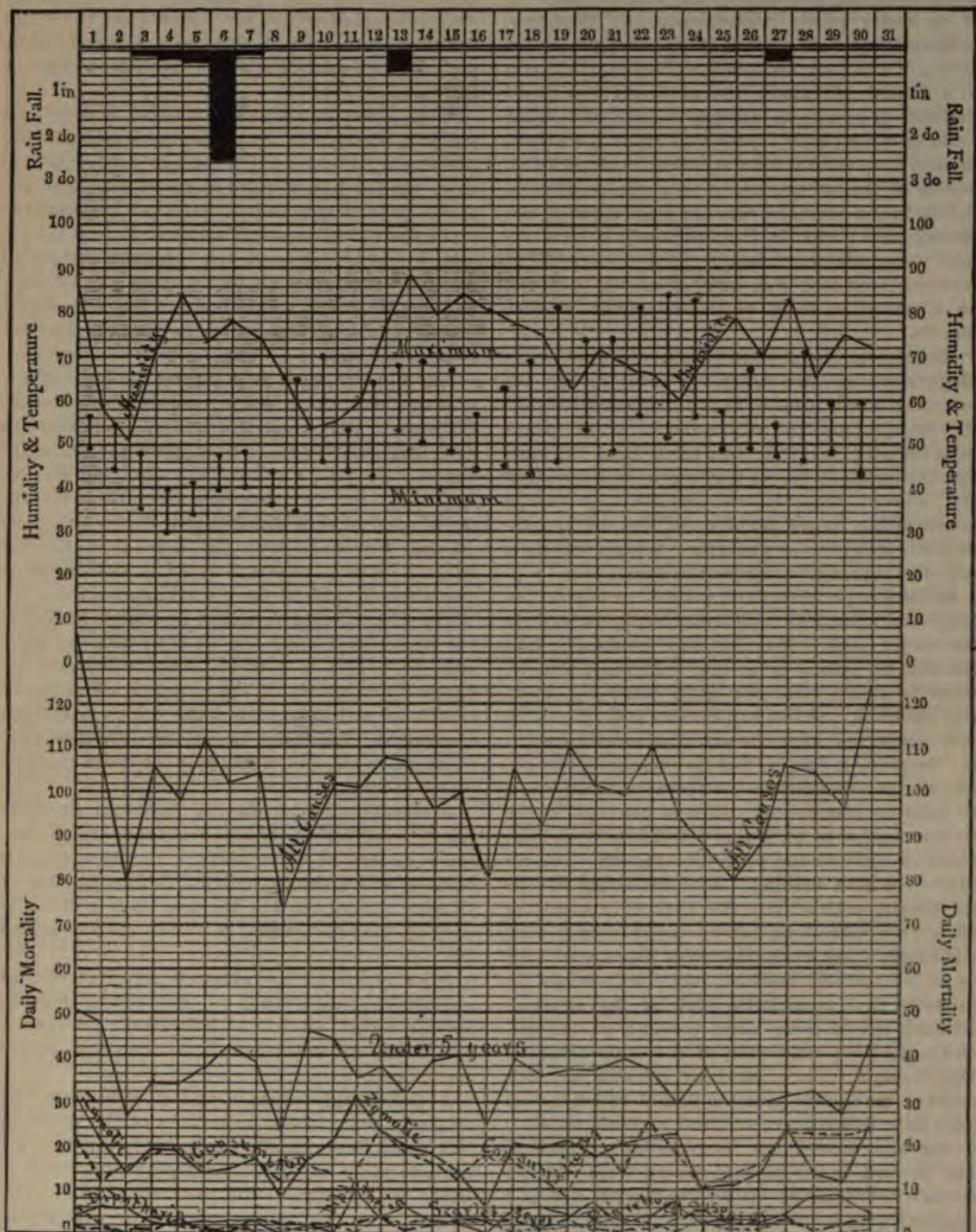
The mean temperature for the month was 52.87°, that for March having been 37.60°. The maximum was on the twenty-third day, the thermometer then registering 84°. This is the highest recorded in the month of April since 1871. 62° was the highest point reached by the mercury during March: its lowest point in that month was 8°, while during April at no time was it more than two degrees below freezing.

While the number of days upon which rain fell was but seven, rather less than the average for a considerable number of years, yet the total amount of water which fell was 3.85 inches, considerably above the average amount for the same period. On the 4th of the month one-quarter of an inch of snow fell, and three-quarters of an inch on the day following. In the corresponding month of 1885, there were several flurries of snow, the amount being too small to accurately measure. Snow is not a frequent visitor in the month of April: in the year 1870 it fell to the depth of two inches and a half; in 1875 no less than thirteen inches and a half are recorded; and in the years 1882 and 1883 there was in each one half-inch. With these exceptions, no snow has fallen in April during the past fifteen years. From a meteorological point of view, April, 1886, was an exceptional month.

SYMPATHETIC VIBRATIONS OF JETS.[1]

AFTER a brief historical notice of the observations of Savart, Masson, Sondhauss, Kundt, Laconte, Barret and Tyndall, Decharme, and Neyreneuf, on the sympathetic vibrations of jets and flames. the author described his own experiments. Attention was directed to the subject by the accidental observation that a pulsating air-jet directed against a flame caused the latter to emit a musical sound. The pitch of this sound depended solely on the rapidity of the jet-pulsations, but its intensity was found to increase in a remarkable way with the distance of the flame from the orifice. In order to study the phenomenon, air was allowed to escape against the flame from a small orifice in the diaphragm of an ordinary telephone, the chamber behind the diaphragm

[1] Abstract of paper read before the Royal society, April 28, by Chichester A. Bell.



Weekly Mortality	726	683	697	694	
Weekly mean Thermometer	45.7°F	44.0 F	52.9 F	64.0 F	
Weekly mean Barometer	29.977	29.919	30.304	30.023	

being placed in communication with a reservoir of air under gentle pressure (fig. 1). Vibratory motions being then excited in the diaphragm, by means of a battery and a microphone or rheotome in a distant apartment, the discovery was made that speech as well as musical and other sounds could be quite loudly reproduced from the flame. Certain observations led the author to suspect that motion of the orifice, rather than compression of the air in the chamber, was the chief agent in the phenomenon; and, in fact, precisely similar results were obtained when a light glass jet-tube was cemented to a soft iron armature, mounted on a spring in front of the telephone magnet (fig. 2).

Experiment also showed that an air-jet at suitable pressure directed against a flame repeats all sounds or words uttered in the neighborhood (fig. 3). Except, however, where the impressed vibrations do not differ widely in pitch from the normal vibrations of the jet (discovered by Sondhauss and Masson), these effects are likely to escape notice owing to the inability of the ear to distinguish between the disturbing sounds and their echo-like reproduction from the flame.

In these experiments the primary action of the impressed vibrations was undoubtedly exerted on the air-jet; but a singular and perplexing fact was that no sound, or at best very faint sounds, could be heard from the latter when the flame was removed, and the ear, or the end of a wide tube connected with the ear, was substituted for it. Suspecting, finally, that the changes in the jet, effective in producing sound from the flame, must be relative changes of different parts of it, the author was led to try a very small hearing-orifice, about as large as the jet-orifice (fig. 4). The results were most striking. By introducing this little hearing-orifice into the path of a vibrating air-jet, the vibrations can be heard over a very wide area. Close to the jet-orifice they are so faint as to be scarcely audible; but they increase in intensity in a remarkable way as the hearing-orifice is moved away along the axis of the jet, and reach their maximum at a certain distance. Experiments with smoked air showed that this point of maximum sound is that at which the jet loses its rod-like character, and expands rapidly: it has been named the 'breaking-point,' because just beyond it the sounds heard from the jet acquire a broken or rattling character, and at a greater distance are completely lost. The distance of the breaking-point from the orifice diminishes as the intensity of the disturbing vibrations is increased, and also depends to some extent on their pitch and on the velocity of the jet. With orifices of from 1 to 1.5 mm. in diameter, it usually varies from 1 to 6 cm. The vibrations of an air-jet may also be heard at points not situated on the axis; but they are always most intense along the axis, and become rapidly fainter as the distance from it increases.

With glass jet and hearing-tubes, and a light gas bag to serve as reservoir, these experiments are easily repeated; but simple apparatus for more careful experiments is described. The author's general conclusions from his experiments and those of others are as follows: —

A jet of air at moderate pressure (below 10 mm. of water) from an orifice from 1 to 1.5 mm. in diameter, forms a continuous column for a certain distance, beyond which it expands and becomes confused.

Any impulse, such as a tap on the jet support, or a short and sharp sound, causes a minute disturbance to start from the orifice. This disturbance increases in area as it progresses, and finally causes the jet to break. By directing the jet against a flame or a hearing-orifice, it is readily perceived that such disturbances travel along the jet-path with a velocity which is not that of sound in air. In fact, the sound heard in the ear-piece resembles an echo of the disturbing sound.

The disturbances produced by sounds of different pitch travel along the jet-path with the same velocity. This is evident, since otherwise accurate reproduction of the complex vibrations of speech at a distance from the orifice would be impossible. This velocity is much less than that of sound in air, and is probably the mean velocity of the stream.

A vibrating air-jet playing into free air gives rise to very feeble sounds, but these sounds are much intensified when the jet impinges on any obstacle which serves to divide it into two parts. Of such arrangements, the best is a perforated surface, the orifice being placed in the axis of the jet.

A jet of air at low pressure responds to and reproduces only sounds of low pitch. Sounds above a certain pitch, which depends on the pressure, either do not affect it or are only faintly reproduced.

At pressures between 10 and 12 mm. of water, an air-jet reproduces all the tones of the speaking voice, and those usually employed in music, with the exception of very shrill or hissing noises. When the pressure in the reservoir equals about 13 mm. of water, hissing sounds are well reproduced, while sounds of low pitch become fainter. At higher pressures, up to about 25 mm. of water, shrill or hissing noises produce very violent disturbance, while ordinary speech tones have little effect. But at these pressures sounds of high

pitch frequently cause the jet to emit lower sounds of which they are harmonics.

In general a pressure of about 12 mm. of water will be found most suitable for reproducing speech or music. Under this condition the jet is very sensitive to disturbances of all kinds, and will reproduce speech, music, and the irregular sounds classified as 'noises.'

It must be understood that the pressures here given are only suitable for jets of not too small diameter. When the diameter of the orifice is only a small fraction of a millimetre, the above limits may be much exceeded, since the velocity of efflux no longer depends solely on the pressure.

A jet of air escaping from a perfectly circular orifice does not vibrate spontaneously so as to emit a musical sound; but musical vibrations may be excited in it by the passage of the air on its way to the orifice through a resonant cavity, or through any irregular constriction.

An air-jet impinging on any obstacle, such as a flame, frequently vibrates spontaneously, if the obstacle is at sufficient distance and of such a nature as to diffuse the disturbances produced by impact, or throw them back on the orifice. This constitutes one of the chief objections to the use of a flame as a means of rendering audible the vibrations of a jet. The disturbances excited in the surrounding air by the impact of the stream upon it are so intense as easily to react on the orifice. When, therefore, the jet is thrown into any state of vibration, it tends to continue in the same state, even after the exciting sound has ceased.

A jet of air usually responds most energetically to some particular tone or set of related tones (Sondhauss). Such a particular tone may be called the jet fundamental. The practical inconvenience arising from this may be diminished by raising the air-pressure until the jet fundamental is higher than any of the tones to be reproduced.

When a flame and an air-jet meet at right angles, vibrations impressed upon the flame-orifice also yield sound. The conditions of pressure, etc., are somewhat different; but the changes produced at the orifice grow in the same way as those in an air-jet. The best results are obtained when a gentle current of air is directed from a wide tube just below the apex of the blue zone.

It is difficult, at first sight, to account for the fact that a vibrating jet gives rise to sound only when it strikes upon some object which divides it into two parts. The following experiments, however, in some sense explain this. The relative normal velocity at different points in the stream may be measured by introducing into its path the open end of a capillary tube which is connected with a water manometer. This velocity diminishes continuously along the axis from the orifice to the breaking-point, and also diminishes continuously from any point of the axis outwards towards the circumference. Now, a sudden disturbance communicated to the air at the orifice will be found to produce a fall in velocity along the axis of the jet, but a rise in velocity along its extreme outer portions. It thus appears that the changes along the axis and along the circumference, produced by a disturbance, are of opposite character. When the jet plays into free air, these opposing changes neutralize each other in the main; but this interference is prevented when the jet strikes upon any object which serves to divide it.

When a vibrating air-jet plays against a small flame, the best sounds are heard when the stream strikes the flame just below the apex of the blue zone. At the plane of contact an intensely blue flame ring appears, and this ring vibrates visibly when the jet is disturbed. The production of sound from it doubtless depends on changes in the rate of combustion of the gas. This may be proved by inserting into the ring a fine slip of platinum, connected in circuit with a battery and a telephone (fig. 5). When the jet is thrown into vibration, the consequent variations in the temperature of the platinum affect its conductivity, and hence a feeble reproduction of the jet-vibration may be heard in the telephone.

To Savart we are mainly indebted for our knowledge of the sympathetic vibrations of liquid jets. This physicist showed that a liquid jet always tends to separate into drops at a distance from the orifice in a regular manner; and that this tendency is so well marked, that when the jet strikes upon any object, such as a stretched membrane, so arranged that the disturbances caused by impact may be conducted back to the orifice, a definite musical sound is produced. The pitch of the sound, or the number of drops separated in a given time, varies directly as the square root of the height of liquid in the reservoir, and inversely as the diameter of the orifice. Savart further showed that external vibrations impressed upon the orifice may act like the impact disturbances, and cause the jet to divide into drops. Impact on a stretched membrane may then cause the reproduction as sound of the impressed vibrations. The tones capable of producing this effect were considered to lie within the limits of an octavo below and a fifth above the jet normal.

The author has found, however, that jets of every mobile liquid are capable of responding to

FIG. I.

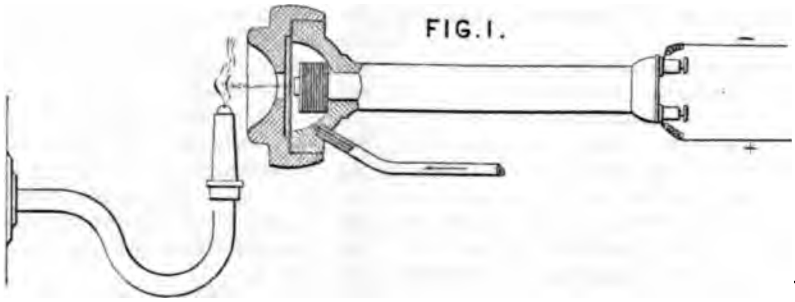


FIG. II.

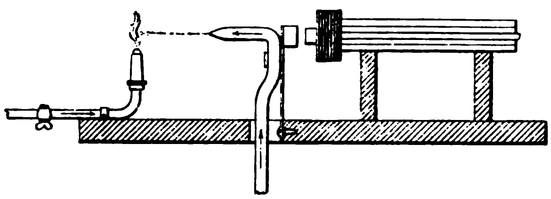


FIG. III.

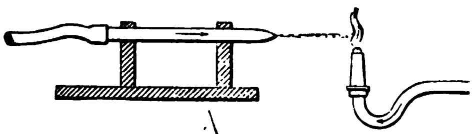
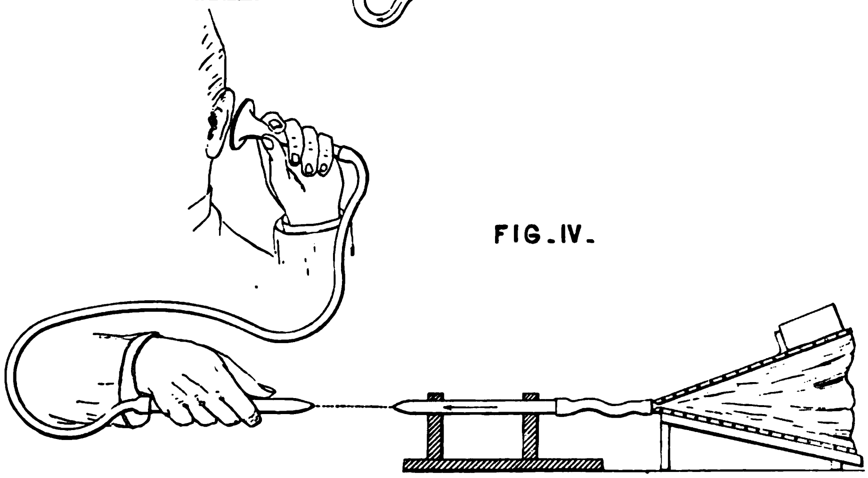


FIG. IV.



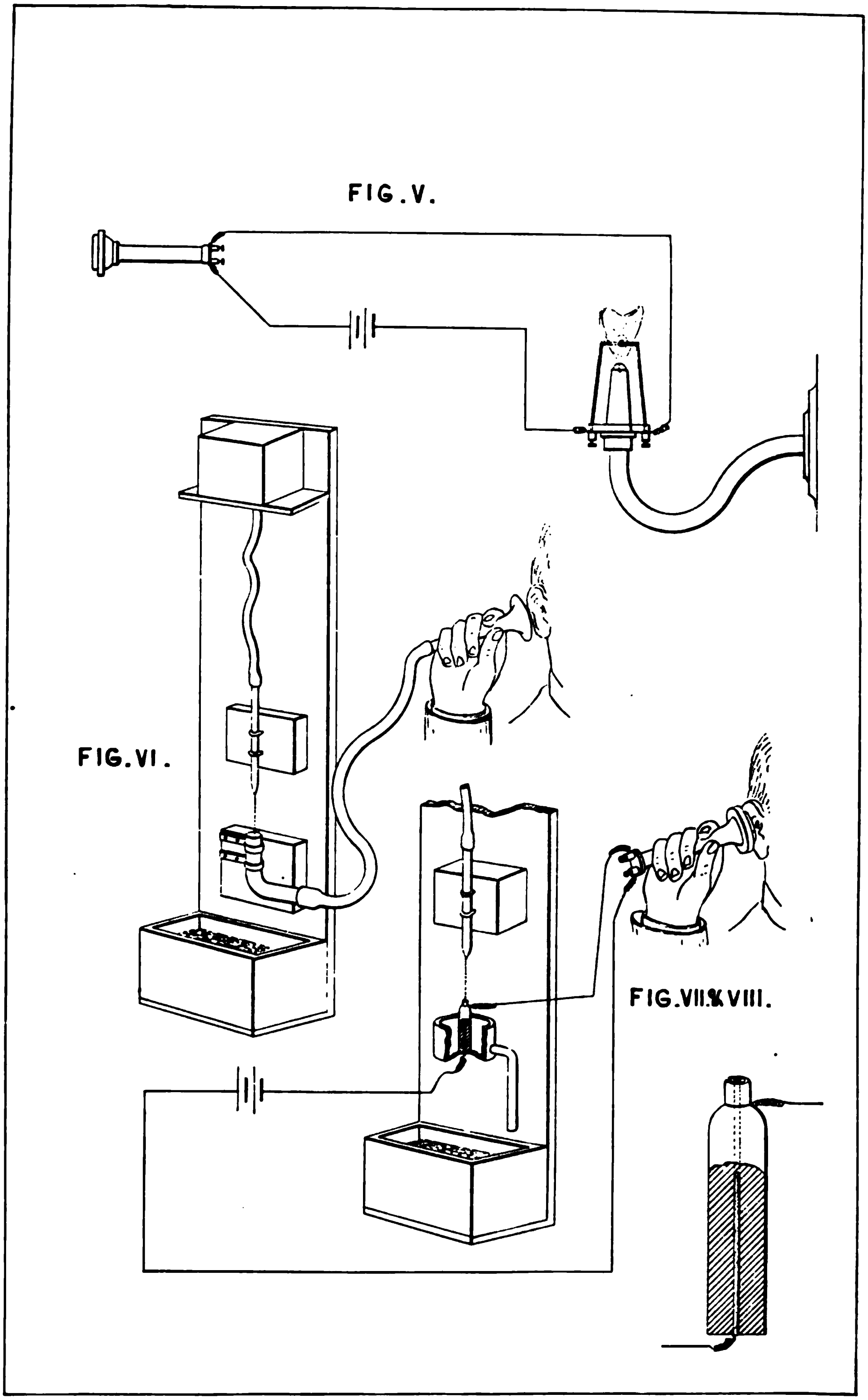


FIG. V.

FIG. VI.

FIG. VII. & VIII.

and reproducing all sounds whose pitch is below that of the jet normal, as well as some above; and that the timbre or quality of the impressed vibrations is also preserved, provided that the jet is at such pressure as to be capable of readily responding to all the overtones which confer this quality.

Other essential conditions for perfect reproduction are, that the receiving-membrane should be placed at such distance from the orifice that the jet never breaks into drops above its surface, and that it should be insulated as carefully as possible from the orifice.

In order to assist the action of aerial sound-waves on the fluid, it is advisable to attach the jet-tube rigidly to a pine sound-board about three-eighths of an inch thick. The surfaces of the board should be free, otherwise it may be supported in any way. The receiving-membrane is formed by a piece of thin sheet-rubber tied over the end of a brass tube about three-eighths of an inch in internal diameter. A wide flexible hearing-tube furnished with an ear-piece is attached to the brass tube. The jet-tube is connected with an elevated reservoir by an india-rubber pipe (fig. 6).

With an apparatus of this kind, and a tolerably wide jet-tube having an orifice about 0.7 mm. in diameter, a pressure of about 15 decimetres of water is required to bring the jet into condition to respond to all the tones and overtones of the speaking voice (except hissing sounds) and those employed in music. At a somewhat higher pressure it will reproduce hissing sounds. It is not easy for an untrained ear to distinguish between the disturbing sounds and their reproduction by the jet, when both are within range of hearing. Vibrations may, however, be conveyed to a jet from a distance in a fairly satisfactory way by attaching one end of a thin cord to the jet-support, and the other to the centre of a parchment drum. The cord being stretched, an assistant may speak, sing, or whistle to the distant drum. Other devices for conveying vibrations from a distance are described.

Now, when the jet is disturbed in any way, and the receiving-membrane is introduced into its path close to the orifice, scarcely any sound can be heard in the ear-piece; but, if the membrane be moved away from the orifice along the path of the jet, the sounds become gradually louder, until at a certain distance (which varies both with the character of the orifice and the intensity of the impressed vibrations) a position of maximum purity and loudness is reached. At greater distances the reproduction by the jet becomes at first rattling and harsh, and finally unintelligible. In the latter case the jet will be seen to break above the membrane.

From this experiment we may draw the conclusions previously arrived at for air-jets; viz., that all changes produced by sound at the orifice grow in accordance with the same law; and that all changes travel with the same velocity, which is probably the mean velocity of the stream.

The mode in which the jet acts upon the membrane becomes apparent when instantaneous shadow-photographs of vibrating jets are examined. When the jet is steady, and the orifice strictly circular and well insulated, the outline in the upper part of the stream is that of a slightly conical rod, the base of the cone being at the orifice. When, however, vibrations are impressed upon the support, swellings and constrictions appear on the surface of the rod, which become more pronounced as the fluid travels downwards. At the breaking-point the constrictions give way, those due to the more energetic sound-impulses being the first to break. When the impressed vibrations are complex, the outline of the jet may be very complicated. When the membrane is interposed, we have then a constantly changing mass of liquid hurled against it, and vibratory movements are therefore excited in it, proportional to the varying cross-section of the jet at its surface.

It would appear at first sight that the mode of growth of the vibratory changes in a liquid jet must be different from that which characterizes the vibrations of an air-jet. It is possible, however, by special arrangements, to receive the impact of only a small section of a vibrating liquid jet, and thus to get a reproduction of its vibrations as sound. We are thus led to conclude that the sound-effects of a vibrating liquid jet may not be simply due to its varying cross-section, since actual changes occur in the translation- or rotation-velocity of its particles. Experiment shows that these changes are greatest along the axis of the jet.

One of the most interesting and beautiful methods of studying the vibrations of a jet consists in placing some portion of it in circuit with a battery and telephone, whereby its vibrations become audible in the telephone. A number of forms of apparatus for this purpose have been constructed, but one will serve as a type. Savart, in the course of his experiments, showed that the vibrations of the jet are preserved in the 'nappe,' or thin sheet of fluid formed when the jet strikes normally on a small surface. So far, then, as vibratory changes are concerned, the nappe has all the properties of the main stream. Although the diameter of this excessively thin film is about the same whatever be the distance of the surface

from the orifice, the intensity of the vibratory changes propagated to it varies with this distance, as for the jet itself. It is simply necessary, then, to insert into the nappe two platinum electrodes in circuit with a telephone and a battery having an electromotive force of from twelve to thirty volts, to get an accurate and faithful reproduction of the jet-vibrations. Loud sounds can thus be obtained from a jet which is finer than the finest needle, and the arrangement constitutes a highly sensitive 'transmitter' (figs. 7 and 8).

A jet-transmitter, in its simplest form, consists essentially of a glass jet-tube which is rigidly attached to a sound-board, and supplied from an elevated reservoir containing some conducting-liquid (distilled water acidified with one three-hundredth of its volume of pure sulphuric acid is the best), and a couple of platinum electrodes embedded in an insulator, such as ebonite, against which the jet strikes. The jet may issue from a circular orifice, about 0.25 mm. in diameter, in the blunt and thin-sided end of a small glass tube. Much smaller jets may be used, but, for one of the given size, the pressure required for distinct transmission of all kinds of sounds will not exceed thirty inches. The receiving-surface is the rounded end of an ebonite rod, through the centre of which passes a platinum wire. The upper end of the rod should be about 1 mm. in diameter, and should be surrounded by a little tube of platinum; and the end of the central wire and the upper margin of the tube should form a continuous slightly convex surface with the ebonite, free from irregularities. The inner and outer platinum electrodes are joined respectively to the terminals of the circuit. The jet is allowed to strike on the end of the central wire, and, thence radiating in the form of a nappe, comes into contact with the tube, thus completing the circuit. The dimensions of the apparatus may be varied to suit jets of different sizes; it is highly desirable, however, that the jet nappe should well overlap the inner margin of the ring-shaped electrode.

With small jets the impact disturbances are so feeble, that slight precautions are necessary to insulate the receiving-surface from the orifice, unless the former is placed low down in the path. The strength of battery may be increased until the escape of electrolytic gas-bubbles causes a faint hissing noise in the telephone. The liquid, on its way to the jet, should pass downwards through a wide tube lightly packed with coarse clean cotton, by which minute air-bubbles which violently disturb the jet, and small particles of dust which might obstruct the orifice, are stopped. This tube should never be allowed to empty itself.

Experiments are given to show that in this instrument the jet may act upon the electric current in two ways: first, by interposing a constantly changing liquid resistance between the electrodes; and, second, by causing changes in the so-called 'polarization' of the electrodes. In one form of instrument, namely, that in which both jet and electrodes are entirely immersed in a mass of liquid of the same kind as the jet liquid, the action must be entirely at the surface of the electrodes.

In the latter case a liquid jet becomes similar in structure and properties to a jet of air in air, and the velocity at different points when it is steady and when it is disturbed varies in precisely the manner already described.

The author briefly passed in review the leading facts to be accounted for, and laid stress upon the parallelism of the properties of gaseous and liquid jets. Some shadow-photographs of vibrating smoke jets have shown that these also present drop-like swellings and contractions which grow along the jet-path. The most satisfactory explanation of the phenomena will then be one which refers the vibratory changes in jets of both kinds to the same origin.

The beautiful and well-known experiments of Plateau have supplied a satisfactory explanation of the normal vibrations of a liquid jet in air. He has shown that a stationary liquid cylinder, whose length exceeds a certain multiple of its diameter, must break up, under the influence of the 'forces of figure,' into shorter cylinders of definite length, which, when liberated, tend to contract into drops. Now, the jet being regarded as such a stationary cylinder, we have a satisfactory explanation of the musical tone resulting when its discontinuous part strikes upon a stretched membrane, and when the impact disturbances may be in any way conducted back to the orifice. These disturbances then accelerate the division of the jet after it leaves the orifice. Plateau endeavored to show that division of the jet might take place at other than the normal points, thus explaining Savart's conclusion that a jet can vibrate in sympathy with a limited range of tones. Lord Rayleigh, moreover, has recently shown that the inferior limit of this range is not so sharply defined theoretically as Savart's experiments would prove it to be.

Both Savart and Magnus, however, describe experiments in which a water-jet, carefully protected from impact and other disturbances, does not exhibit the peculiar appearances characteristic of rhythmical division; and the author's experiments conclusively prove that this rhythmical division does not take place in a well-insulated jet. While the tendency so to divide may therefore be admitted, and the normal rate of vibration of the jet

and its greater sensitiveness to particular tones may thereby be explained, Plateau's theory cannot be held to account for the uniform growth, along the jet-path, of all changes, however complex their form; for this growth takes place independently of the 'forces of figure,' and under conditions in which they are entirely absent, as when a gaseous or liquid jet plays within a mass of fluid of its own kind.

The author is inclined, rather, to refer the properties of jets of all kinds to conditions of motion on which hitherto little stress has been laid; viz., the unequal velocities at different points in the stream after it has left the orifice. From the axis towards the circumference of a jet near the orifice, the velocity diminishes continuously, and the motions of the stream may be regarded as resultants of the motions of an infinite series of parallel and co-axial vortex-rings. In many respects, in fact, the appearance of a jet resembles the appearance of a vortex-ring projected from the same orifice. Thus a jet from a circular orifice, like a vortex-ring from a round aperture, remains always circular. In a frictionless fluid a vortex-ring, uninfluenced by other vortices, would remain of constant diameter, — a condition to which a horizontal liquid jet approximates. When, however, the ring moves through a viscous fluid, it experiences retardation and expansion, which are precisely the changes which a jet playing in a fluid of its own kind undergoes. The vibrating smoke-ring projected from an elliptical aperture changes its form in exactly the same manner as a jet, at sufficiently low pressure, from an elliptical orifice. These analogies might be considerably extended.

In a liquid jet in air or in a vacuum, internal friction must gradually equalize the velocities. At a distance from the orifice, therefore, depending on the viscosity of the liquid, such a jet must approach the condition of a cylinder at rest, and must tend to divide in accordance with Plateau's law. The rapidity with which drops are formed depends mainly on the superficial tension of the liquid. The length of the continuous column should therefore bear some inverse ratio to the viscosity and superficial tension of the liquid, — a view which is in harmony with the results of Savart's experiments, and some of the author's, in this direction.

Where the jet plays into a fluid of its own kind, the retardation and expansion which it experiences are mainly due to its parting with its energy to the surrounding medium. When, as a result of vibration, growing swellings and contractions are formed in it, this loss must be more rapid: and the jet therefore shows a diminution of mean velocity along the axis, which increases with the distance from the orifice.

Such being the conditions, it is evident that any impulse communicated to the fluid, either behind or external to the orifice, or to the orifice itself, must alter the vorticity of the stream. That vortex-rings are generated by impulses of the first kind is well known; the action when the orifice is moved is intelligible, if we consider that a forward motion of it will produce acceleration, a backward motion retardation, of the outer layers of the jet. As the result of a rapid to-and-fro motion, we may then imagine two vortex-rings to be developed; the foremost layer of greater energy, and moving more slowly, than the hindmost. These two rings, in their onward course, will then act on each other in a known manner: the first will grow in size and energy at the expense of the second, at the same time diminishing in velocity; the second will contract while its velocity increases. The inequalities in cross-section, initiated at the orifice, thus tend to grow along the jet-path, and will be attended also by growing inequalities of the normal and rotational velocities of the particles. Since the stream-lines of a vortex-ring are crowded together at its centre, the disturbances produced by impact of the jet-rings will be greatest along the axis, and least along the circumference.

Indeed, the sound disturbances produced by impact of a common vortex-ring are quite analogous to those of a vibrating jet. Let an air-ring be projected into a trumpet-shaped tube connected with the ear, and little more than a rushing noise will result; but let it be projected against a small orifice in the hearing tube, and a sharp click will be heard at the moment of impact. This click is loud when the centre of the ring strikes the tube, but faint, although still of the same character, when produced from the circumference.

The foregoing considerations may be extended to cases in which the motions of the orifice are complex vibrations. Expansions and contractions are then initiated in the fluid proportional at every point to the velocity of the orifice. The inequalities must tend to further diverge in the manner described.

Similar considerations apply to cases in which the motions of the orifice are the result of lateral impulses. In these cases the rings formed in the jet will not be perpendicular to its direction, and in their onward course may possibly vibrate about a mean position.

The author further pointed out how the viscosity and surface-tension of the fluid may influence its sensitiveness. When the surface-tension is very high, as in mercury, it produces a tendency in the

jet to break easily under the influence of moderate impulses.

The foregoing is ttle m ore than the outlines of a new theory of jet-vibrations. The author hopes to supply in the future further experimental evidence in support of it.

BOSTON LETTER.

EVIDENTLY one should join the Essex institute in Salem if one wishes to live to a green old age. This well-honored scientific body held its annual meeting recently; and the secretary's report showed, that, of the 24 deaths during the year, all but one were of persons over fifty years of age. Moreover, of the 324 living members, two-thirds are over threescore years and ten, and seven are past fourscore. The institute is soon to go into new quarters.

Preparations are making for the celebration at Cambridge of the two hundred and fiftieth anniversary of the founding of Harvard college. It will not take place at the commencement season, but at some time the following autumn, and it seems to be generally understood that Hon. James Russell Lowell will preside. It will be a different thing from the bicentenary, when a smaller audience-room than is now available permitted even all the undergraduates to find a place. The living Harvard alumni alone are probably three times the number living fifty years ago, and certainly the undergraduates are five times as numerous as then. This event makes specially appropriate the list just published by the university, showing the literary activity of its officers during the last five years. A similar ten-years list was published in 1880; but the present, though only for half that time, not only contains a longer list of publications than the former, but a somewhat larger number of writers among the officers.

Gifts continue to come in to the university. Mrs. Draper of New York continues to further the researches to which the late Dr. Henry Draper devoted his life. Her latest gift is of a thousand dollars to Harvard college observatory, to be expended under the direction of Professor Pickering in prosecuting researches in the photography of stellar spectra; the eleven-inch photographic lens constructed by Dr. Draper will be employed in this work, and those who heard Professor Pickering's account, at the Albany meeting of the National academy last autumn, of his own work in the field in which Dr. Draper's name is so honorably associated, will believe that Mrs. Draper has made an excellent choice.

In this same connection it should be mentioned that the contest at law about the Paine bequest to the Harvard observatory, mention of which has before been made in this correspondence, is happily closed by amicable settlement between the parties concerned. The amount which will now be turned over to the observatory, probably within the next month or two, will scarcely differ from that previously announced, and on the death of the widow it is probable that the entire bequest will exceed three hundred thousand dollars. Those who have followed the telling activity of the observatory under its present management will be confident that no other institution could make better use of such a noble gift.

At the annual meeting of the American academy, May 25, it was voted to present the Rumford gold and silver medal to Professor Langley of the Allegheny observatory, for his researches in radiant energy. Thus Professor Langley has in a single year borne off the two principal gold medals given for scientific work in America, having received the Draper medal of the National academy only last month. No one will dispute his right to them. The Rumford fund will also be used this year by the American academy in aid of researches upon the solar corona at the time of the total eclipse of August next, five hundred dollars having been appropriated in aid of Mr. W. H. Pickering's expedition to the West Indies. A letter was read from Mr. Greenough the sculptor, a fellow of the academy, announcing his gift to the academy of a portrait of Galileo, which he stated was either an old copy or a replica of the portrait in the Pitti palace. The portrait is already on its way to America.

In passing through Mount Auburn cemetery the other day I observed for the first time the monument which has been erected at the grave of Pourtalès, the colleague of Agassiz, and the pioneer in the zoölogy of the deep seas. It is a simple but massive semicircular slab of very fine-grained sandstone, on one face of which is the usual inscription, while on the other, facing the grave, has been deeply engraved a conventionalized Pecten-like sea-shell, forming a sort of niche; and on the surface of this are neatly sculptured in bas-relief a coral, a Comatula, a Gorgonia, and a magnified foraminifer, emblematic of the subjects of his study.

The topographical field-parties of the U. S. geological survey have begun their season's operations in this state, and before next winter most of the field-work will have been finished. The Appalachian mountain club, taking advantage of the work already completed, is about to issue, by permission of the survey, a photolithograph of a portion of the field-sheets on the original scale, comprising the extreme north-western corner of

the state, with Greylock, our highest mountain mass. Contours will be shown twenty feet apart, and bring out in fine relief the bolder slopes of this part of the state. Y.

Boston, June 1.

NOTES AND NEWS.

THE Imperial university of Japan (Teikoku-Daigaku), founded by imperial decree of March 1, 1886, includes the two institutions formerly known as the Tōkyō university (Tōkyō Daigaku) and the Imperial college of engineering (Kobu-Daigakko), these institutions having ceased to exist. The university comprises five colleges, each with its own director; and at its head is the president, Hiromoto Watanabe. The secretary is Kiuichiro Nagai. The directors of the different colleges are: College of law (Hōka-Daigaku), the president (*ex officio*); College of medicine (Ika-Daigaku), Prof. Hiizu Miyake; College of engineering (Kōka-Daigaku), (acting) Prof. Dairoku Kikuchi, M.A. (Cantab.); College of literature (Bunka-Daigaku), Prof. Masakazu Toyama: College of science (Rika-Daigaku), Prof. Dairoku Kikuchi, M.A. (Cantab.). All communications to the Imperial university, whether on its own behalf or as the representative of the two above-mentioned institutions now defunct, should be addressed to the president; communications to the colleges, to the director of each college.

— Dr. Charles Upham Shepard, well known for his collections in mineralogy, died at Charleston, May 1. For a considerable portion of his life he was identified with the South Carolina medical college, and aided greatly in giving that institution an honorable standing. He was also connected with Amherst college: and to this college he gave his vast collection of minerals, which was unfortunately destroyed in 1880.

— A note from Dr. Hyde of Honolulu, to the *Missionary herald* for June, reports that "news has just come that on March 6 the bottom fell out of the volcano, and that Kilauea is now only a black hole in the ground; no lava, no fire, to be seen. But such phenomena have been seen before; and the wonderful crater may fill up again, and be active once more. There were forty-nine earthquakes on the island of Hawaii at the time, and probably some new vent opened for the subterranean fires."

— The house committee on commerce has reported favorably the bill providing for an expert commission to visit Mexico, Brazil, Cuba, and the Central American states for the purpose of investigating the merits of the methods pursued by Drs. Freire and Carmona for the prevention of yellow-fever by inoculation. In their report the committee say, "Dr. Carmona states, that in one series of observations during the prevalence of yellow-fever, of three hundred and eighty persons protected by inoculation, less than three per cent contracted the disease; while under the same circumstances, of one hundred and seventy-five persons not inoculated, thirty-two per cent were seized with it. He also states that seventy-six inoculated soldiers marching from Vera Cruz to Acayucan were joined by a soldier who had not been inoculated. Upon their arrival at the latter place, the unprotected soldier was seized with yellow-fever, and died, while no case of the disease occurred among his seventy-six comrades. Other facts of a similar character are related by Drs. Carmona and Freire, which certainly tend very strongly to show the success of this preventive treatment. It is therefore important that further scientific observations and experiments should be instituted in order to establish beyond controversy the facts relating to this subject, so vital to the interests of sanitary science, commerce, and humanity."

— The following assignments have been made in the topographical department of the geological survey: Mr. Mark Kerr is in Oregon; Prof. A. H. Thompson is in charge of the western division, with headquarters at San Francisco; Mr. Renshaw will be sent to Kansas and Missouri this week; and Mr. Richard Goode will go to Texas.

— The announcement of the death of Von Ranke was succeeded by that of George Waitz, one of his most painstaking and industrious pupils. Professor Waitz was born at Flensberg in 1813. He became professor of history at the University of Kiel in 1842, in 1848 he was a member of the Frankfort assembly, and in 1849 he was called to Göttingen. Waitz succeeded Pertz as editor of the 'Monumenta Germaniae historica,' and in connection with this work he has achieved a considerable reputation. His most important writings are, 'Deutsche verfassungs-geschichte' (2d ed., 1865, 4 vols.), Schleswig-Holstein geschichte' (1851-54, 2 vols.), 'Grundzüge der politik' (1862), and 'Die formeln der deutschen königs- und der römischen kaiserkrönung vom 10 bis zum 10 jahrhundert.' Of late years Professor Waitz has resided in Berlin.

— Pending the action of the appropriation committee, no instructions can be issued by the coast survey to continue work after June 30. As soon as the appropriations are available, preparations will be made to organize parties for field-work after July 1.

—Mr. R. M. Bache has been ordered by the coast survey to continue the topographical work on the south-east shore of Staten Island, and on the south side of Raritan Bay towards Sandy Hook; Mr. F. W. Perkins is daily expected from his field-operations on the coast of Louisiana.

—Velhagen & Klasing (Leipzig) have begun the publication, in twelve monthly parts, of a new edition of Andree's 'Allgemeiner handatlas.' It will contain a hundred and twenty maps.

—The following works of interest to scientific readers have been lately announced: 'Earthquakes and other earth movements,' by John Milne (New York, *Appleton*); 'A manual of mechanics,' by T. M. Gordon (New York, *Appleton*); a work on the labor question in America, by Professor Ely (New York, *Crowell*); 'Photo-engraving processes,' by A. F. W. Leslie (New York, *Fuchs & Lang*); 'The flow of water through pipes and open conduits and from weirs and orifices,' by H. Smith, jun. (London, *Trübner*); 'The world as will and idea,' vols. ii. and iii., by A. Schopenhauer, tr. by R. B. Haldane and J. Kemp (London, *Trübner*); 'The Indian empire: its history, people, and products,' by W. W. Hunter (London, *Trübner*).

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A national zoological garden.

In 1870 an act of incorporation was passed, establishing a zoölogical society in Washington; but during the last sixteen years little or nothing has been done towards carrying out what the charter of this society provides for, or taking any steps in the direction of putting into effect the chief objects such an organization would have in view.

We learn from *Science* (vii. No. 160) that the public-spirited and venerable exhibiter of animals, Mr. P. T. Barnum, now comes forward and says, that, if congress will grant him thirty acres of the reclaimed flats on the Washington side of the Potomac River, he will expend the generous sum of two hundred thousand dollars in starting a national zoölogical garden.

Now, the eastern extension of these flats is not far from the Smithsonian grounds, and, taking every thing else into consideration, there is probably not a better site in this country for this particular purpose. The incalculable advantages that would be the outcome of such an establishment can be easily appreciated; and it is only to be hoped that at an early day congress will take Mr. Barnum's proposition into favorable consideration.

Few institutions in any country afford better educational advantages than a large, well-kept, and well-managed zoölogical garden. No better proof of this can be brought forward than the report of Mr. P. L. Sclater, F.R.S., secretary of the Zoölogical society of London, for the year ending 1885. Mr. Sclater tells us that during the year quoted, 659,896 persons visited the gardens, and that the receipts of the society amounted to the extraordinary sum of £25,809 10s 1d; while during the previous year 745,460 persons visited the gardens, and the receipts were proportionately greater; in fact, £3,129 more.

Many of the larger animals in this country are now rapidly disappearing from off the face of the earth, — notably the bison, the elk, and moose, — while numbers of the smaller representatives of our splendid mammalian and avi-fauna are unfamiliar to the eyes of the vast majority of the people of this country, from the simple fact that we are so poor in institutions where the living specimens can be put on exhibition.

Mr. F. W. True, curator of the department of mammals in the Smithsonian institution, points out in *Science* (vii. No. 171) another deplorable neglect, which unfortunately we are likewise guilty of, and which the establishment of a zoölogical society in Washington would do much towards rectifying. With the disappearance of our larger animals and other vertebrates, the opportunities are forever being placed beyond our reach, to intimately know about the anatomical structure of these very forms. In regard to this, anatomists are too apt to say something like this: "Oh, yes! a prairie dog; no doubt its organization is very much like the squirrel's, and will not repay exhaustive examination." Now, I say that these related and interrelated types are the very ones that will repay the most exhaustive research.

A competent prosector attached to our zoölogical garden — one who combined the qualities of an artist, an author, and a general anatomist — would soon demonstrate the high importance of his work, and contribute the most efficient aid to animal taxonomy. The brilliant productions of Garrod and Forbes, in the Proceedings of the Zoölogical society of London, speak volumes in favor of this advantage.

A share of the pecuniary receipts that would accrue from such an establishment could be set aside to meet the expenses following the publication of handsomely illustrated memoirs, giving large colored plates of the rarer acquisitions to the gardens, and the investigations of the prosector into the structure of such animals as died from time to time, and thus fell into his hands. We have long felt, in this country, the need of just some such standard publication as the excellently conducted Proceedings of the Zoölogical society of London; and this would certainly be realized, and follow as one of the natural results pending the establishment of our national zoölogical garden. R. W. SHUFELDT.

Fort Wingate, N. Mex., May 26.

Scent-organs in some bombycid moths.

At intervals during the past year or two, isolated observations have been made of peculiar filamentary processes protruding from the abdomen of the male of some of our common bombycids, Leucarctia acraea and Scepsis fulvicollis being the observed species. Not long since, I described a peculiar abdominal character in the male of Cosmosoma omphale; and the recent capture and examination of specimens of Leucarctia acraea has enabled me to add something to the knowledge of the structure in that species. Between the seventh and eighth ventral segments is a narrow opening, entirely invisible in the dried insect, but readily discerned on a

slight pressure of the abdomen in the fresh specimen. This opening extends back about an eighth of an inch, and, on being carefully pried open, shows two closely folded tufts of fine blackish hair. Pressure upon the abdomen will generally force out these tufts, and, if rightly applied, will result in the extension of two orange tentacle like structures, fully half an inch in length, united at the base, and spreading backward and outwardly in a gentle curve. The tufts of hair diminish as the tentacles are extended, the individual hairs occupying small but distinct papillae on the sides, until, when fully extended, they are evenly distributed around them, and no trace of the brush-like tuft remains. If the pressure be removed, the tentacles contract, the hairs again forming a tuft.

Specimens of Pyrrharctia isabella, when closely examined, showed a similar abdominal structure; but here there were four tufts extended instead of two, and in color they were snow-white. Properly applied pressure resulted in the inflation, first, of two basal sacs, which, when fully dilated, could be compared to nothing better than the ends of two thumbs pointing in opposite directions, the hairs of two of the tufts arranged rather densely on the convex outer surface. From the middle of the lower edge of these sacs there extended two tentacles similar to those in acraea, but not so long; and instead of being evenly clothed with hair, in this species the lower portion only has the papillae and hairy surface. The sacs and tentacles here are whitish, instead of orange, as in acraea. The processes of the latter species have a most remarkable resemblance to the tentacles of the larva of the common Papilio asterias, both in color and in shape. In both species an intense odor, somewhat like the smell of laudanum, is apparent when first the tentacles are exposed; and there is no reasonable doubt but that they are odor-glands, though exactly what purpose they serve is not so clear. In closely allied species no trace of this structure has been detected. Several fresh specimens of Arctia, Spilosoma virginica, and Hyphantria textor showed no trace of it; and no dry specimens of any other species thus far examined have a similar structure.

JOHN B. SMITH,
Assistant curator.

U. S. national museum.
Washington, D.C., May 23.

Muscles of the hind-limb of Cheiromeles torquatus.

I desire to place on record some observations I have recently made on the muscles of the hind-limb of Cheiromeles torquatus. This bat is one of the most interesting of the Cheiroptera. It is to a great extent arboreal in its habits. The wings are small, the body heavy and uncouth, and the wing-membranes are so arranged as to accommodate the young within a pouch on the back instead of on the front of the chest, as is the case in most of the bats. As a consequence, I expected to find in the musculature of the hind-limbs structures recalling those of other orders of mammals rather than those of the bats generally. In the main these anticipations have been met. It has always been supposed that the popliteus, the biceps, the soleus, and plantaris muscles are absent in the bats. It is true that Macalister finds in Vampyrops a few oblique fibres 'like a rudimental popliteus,' and Humphry identifies a small fascicle in Pteropus as biceps; but with these exceptions, as Macalister says, "there is no trace of biceps, popliteus, soleus, or plantaris in any." There is no doubt that the popliteus, the biceps, and the plantaris are present in Cheiromeles. The soleus is the only one of the absentees which is unaccounted for.

The maintenance of this group of muscles in a bat which is specialized for a tree-life, and scurries about the trunk after a fashion much like that of Pteromys, suggests the conclusion that the muscles named (excepting the soleus) are essential to the simplest expression of a true act of walking. They are absent in the volant bats, since they are of no use in flight; but they at once re-appear when the limbs are used for walking, or for the movements which are similar to this act. The assumption here taken that Cheiromeles is a true bat, which has been specially modified from the typical bat, is, I believe, tenable, and need not be here discussed. Occasion will be taken in due time to present arguments to sustain it. I will be content now to record the existence of the muscles named, and to give brief descriptions of them.

The popliteus is a well-defined muscle which slightly overlies the origin of the tibialis posticus. It does not create an oblique line on the tibia, which is so characteristic of the muscle in the mammals generally.

The plantaris is a conspicuous muscle, and is larger and heavier than is the gastrocnemius. It is distinct from the gastrocnemius its entire length. The muscle passes down to the sole of the foot, where it is continuous with the plantar fascia. Traction on the muscle flexes and abducts the foot.

A single muscular mass attached to the ischium represents the semi-membranosus and the biceps. The biceps becomes free at the upper fourth of the thigh, and is inserted into the head of the fibula.

The muscle which represents the tibialis posticus and flexor longus digitorum arises from the upper part of both the tibia and the fibula. It remains fleshy until it reaches the neighborhood of the tarsus, when two distinct tendons appear. One of these may be said to represent the flexor longus digitorum. It passes superficially over the ankle, and is lost on the plantar surface. Traction on the tendon abducts the foot, but does not flex the toes. The tendon of the tibialis anticus is lost on the tarsus. Traction on this muscle exerts no apparent influence on the movements of the tarsus.

HARRISON ALLEN.

Philadelphia, May 25.

Double vision.

In your issue of May 14, p. 440, Mr. Keller describes some phenomena of binocular vision, and asks an explanation. It would be impossible to do this in a short communication, but he will find the subject explained in any work on binocular vision. Perhaps the most accessible to him is my own little volume, entitled 'Sight' (International scientific series, vol. xxxi.). For explanation of phantom images, I would refer him to the chapters on 'Single and double images,' and on 'Superposition of external images,' and especially to the diagram on p. 116; and for explanation of inequalities of surface of such images, to p. 141 and preceding pages.

JOSEPH LECONTE.

Berkeley, Cal., May 24.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 4, 1886.

AN INDIAN SNAKE-DANCE.[1]

THE worship of the serpent has been so closely connected with the mythologic systems of so many primitive peoples, and has exercised so large an influence on religion, that any facts bearing on the subject must be of interest. It has even been said that this form of worship was more widely and universally distributed than any other. In Egypt, at the dawn of history, serpent-worship had already assumed the highest importance. Among the Phoenicians and in ancient Persia the serpent was worshipped as an evil deity, and also at a later period among the German tribes of the north; and the same myth may be traced in a modified form in the legendary history of the Greeks and Romans. Among the Hebrews there existed a strong tendency to this form of worship, — a tendency which, though repeatedly crushed out by the hand of power, as often re-asserted itself; and so late as eight hundred years after Moses it was prevalent in one of its grossest forms, for we read in 2 Kings xviii. 4, "He removed the high places, and brake the images, and cut down the groves, and brake in pieces the brazen serpent that Moses had made: for unto those days the children of Israel did burn incense to it." With the Chinese the serpent is a "symbolic monster, dwelling in spring above the clouds to give rain, and in autumn under the waters." It is in this connection, i.e., in connection with rain, that the performance that I am about to describe, occurred. In India the serpent was regarded as the great evil spirit, and Krishna is represented as crushing its head beneath his heel.

To come nearer home, the myth was very widely distributed among the North American tribes at the time of the discovery, in many of them in the form of pure ancestor-worship, but in others not so connected. It was common among the mound-builders, as is shown by the number of mounds of the serpent-form still existing, and by the prevalence, in mound relics, of more or less conventionalized representations of the rattlesnake. A recent report of the bureau of ethnology contains illustrations of a number of shell-gorgets, described and figured by Mr. W. H. Holmes, which are engraved to represent snakes.

Nowhere, I think, was the influence of this myth more pronounced than in ancient Mexico; and nowhere, I may add, is it more involved or its meaning more obscure. As the tendency of modern investigation is to show the existence of a remarkable similarity between the ancient Mexican civilization and the pueblo system of our own south-western territories, any facts in regard to serpent-worship among the latter must be of especial interest.

During the early part of the past field-season we were engaged in the investigation of some ruins near the Moki Pueblos, and were so fortunate as to be in that neighborhood at the time of the 'snake-dance' of those Indians. We witnessed this interesting performance twice, — once at Mashongnavi, one of the middle towns of the Moki confederacy, on the 16th of August; and again on the next day at Wolpi, one of the eastern towns. The two dances are essentially the same, the only difference being in the greater number of performers at Wolpi, and in the painting of the body. I have selected the Mashongnavi dance for description, because it has never been described, and had never, to my knowledge, been seen by whites before our visit; while that of Wolpi has been witnessed by many interested persons, several of whom have published, or are about to publish, their accounts.

During several days, before the date fixed for the dance, we frequently met parties of Indians hunting for snakes. The men were perfectly naked, with the exception of the breech-cloth, and each one carried a long red buckskin bag to contain the reptiles, and a feather wand, described later on. As the dance occurs in August, when the temperature during the middle of the day is almost unbearable to a white man, the airy costume of the hunters is a decided advantage to them. Several hunters carried forked sticks.

The snake-hunting occupies four days, one day being devoted to each of the cardinal points of the compass. There is said to be also a supplementary search on the last day, in order to capture any snakes that may have been overlooked previously. About noon of each day groups of hunters visited the several springs lying in that day's section, in order to bathe and rest themselves, and to deposit in crevices in the rocky wall of the spring or reservoir a *baho*, or prayer-stick, — a small round piece of wood half an inch or less in diameter and three or four inches long, generally painted in green and white, and with a feather from the

[1] Read before the Washington anthropological society.

breast of an eagle attached to it. These *bahos* are prayers to the gods that the springs where they are deposited may not dry up, but continue to give an ever-increasing supply. We never saw the ceremony of depositing *bahos*, if ceremony there be, though on several occasions we reached the spring while the hunters were there.

At the end of each day the serpents collected during that day were deposited in an *estufa* situated on the southern edge of the village, the westernmost of a group of three. These *estufas*, or, as the Indians call them, *kivas*, were underground, or partly underground, chambers, a number of which are attached to each village, and form a kind of combined church and court-house, in which is transacted all the religious and civil business of the tribe. They are of various dimensions. Those mentioned here are about twenty-five feet long by twelve in width, and nine feet high. Most of these *kivas* have a slightly elevated *dias*, or platform, occupying a little less than one-half of the ground space, generally the south end. On this platform the women and other spectators stand during the performance of those rites which they are allowed to witness. There were a number of young men who seemed to make this their headquarters during the period of preparation, living in the *kiva* entirely, except when out on a hunt. They usually sallied out during the forenoon, armed with the various paraphernalia before mentioned, and returned to supper or feasting a little before sundown. At one of our visits, on the day before the dance, we found the floor of the *kiva* strewn with buckskin sacks, some empty, others containing snakes; but the bulk of the snake-supply was contained in three large earthenware vessels inverted on a slight bed of sand on the floor. Each vessel had a small hole broken through the bottom, through which the reptile could be passed. These holes were closed by corn-cob stoppers. During the visit, a man brought in another pouch, and released on the floor two small rattlesnakes. The younger men of the band played with these, apparently from simple amusement or curiosity, as there was no ceremonial whatever. They handled the snakes without taking any special precautions to get a safe grip, even holding them occasionally by the middle of the body. After a while they were put into the jars with the others. While one of the snakes was coiled on the floor for a movement, a naked boy walked past it to the other side of the room, passing within six inches of the snake.

The easternmost of the three *kivas* is the snake-*kiva* proper. In this underground chamber, for several days preceding the dance, various rites and ceremonies were performed. On the lower portion of the floor was a peculiar altar, made of various colored sands spread on the floor, and surrounded by lumps of clay in which were stuck small upright sticks with feathers attached. This sand-painting on the floor represented a mass of clouds from which descended four variously colored figures representing either snakes or lightning, the sign for these being apparently the same. Both the clouds and the other figures were very much conventionalized. The colors used were yellow, blue, pink, black, and white. It is unnecessary here to describe the details of this so-called altar or its construction, as the type is already well known through the able descriptions of Dr. Matthews and Col. James Stevenson. I do not think the snakes appear in this *estufa* until immediately before the dance.

We reached the village of Mashongnavi shortly after four o'clock in the afternoon of the appointed day, and found that preparations had been made to hold the dance in the middle court, — an oblong space measuring about a hundred and fifty feet by thirty or thirty-five, and closed all around by houses, with the exception of the narrow passage-ways at the south end nearest the *kivas*, and a large passage on the north, which, however, was not used in this ceremony. Only a part of the available space of the court was utilized. The court had been swept clean; and near the middle, close up to the houses, on the western side, a small conical hut constructed of green cottonwood boughs had been erected. The diameter of the hut, on the ground, was about six feet; and the tops of the highest branches measured about thirteen feet from the ground, though the inside height was probably under five feet. On the east side, flush with the ground, was an opening about two feet and a half square, covered with a piece of buffalo-hide, smooth side out. A little before five o'clock three men dressed in the snake costume came through the narrow opening at the south end on a run. Each carried in his hand a small red buckskin bag containing sacred meal. They entered the hut one at a time, remaining inside a moment. Immediately after these men came two others, dressed also in the snake costume, carrying between them a medium-sized flour-sack nearly full of snakes. These were deposited in the hut, and the whole party returned through the passage by which they had entered. A moment later the procession of dancers filed into the court.

There were two costumes, — that of the antelope gens, under whose auspices the dance was performed; and that of the snake order, the performers. The legend of this dance is the legend of the first arrival of the Mokis at their present

habitat. The antelope gens were the first to arrive, and were guided to their present location by the snake-woman. The snake order was instituted to commemorate this event.

The costume of the antelopes was much more brilliant than that of the snake-men. Each of the former carried in his hand a small, round, T-shaped rattle painted in white and green, the top and edges being white. The fore-arm was covered with white cloth. Around the waist was a sash of cotton embroidered in red and green in geometrical patterns; and hanging down halfway to the knee was a kilt, embroidered in the same style, and, like the sash, woven of cotton. Each performer, both the antelopes and snakes, wore two or more strings of shell beads around his neck, and, suspended from them, a brilliant haliotis shell. When the performer did not possess such a shell, he wore in its place a small circular mirror, such as is furnished by the traders. The breasts and upper arms were decorated in pinkish-white clay, with the conventional snake design,—a zigzag line. Suspended from the back of the sash hung a coyote-skin, the tail of which just reached the ground. The legs, from the knee down, were painted with the clay before mentioned. They wore anklets of red and green worsted on the ankles; and the feet, in some cases were bare, and painted with clay, in others were shod in ordinary moccasons. There seemed to be no rule for the antelope-men. The faces of all the performers were painted black, from the line of the mouth down. Both parties wore a small bunch of red feathers in the hair.

The snake-men wore the same kind of beads and shells as the others. The painting of the body differed somewhat: instead of the zigzag line, they had triangular-shaped blotches of pinkish clay on each breast, and on the upper arms near the shoulders. On the upper arm also, on both sides, they wore bracelets of bark, painted white. The fore-arm was painted with clay. The kilt was of the same style as that worn by the others, but of a red color. Running around it horizontally was a conventionalized drawing of a snake in black and white. At the knee they wore the regular garter in use by all the Indians of this region; and attached to the right leg, just below the knee, was a rattle, formed of a tortoise-shell with attached sheep or antelope hoofs, which made a most dismal clanking sound whenever the wearer moved his leg. The leg, from the knee down, was painted with clay; and the feet were shod in moccasons of red buckskin, with an attached fringe at the top, all looking very new and bright. These performers also wore the wolf-skin.

The leader of the dance, or high priest, carried a buzzing-stick, which failed to work properly, however, and was soon discarded.

The antelope-men, some ten in number, came in first. They entered in single file, and marched around four times in an irregular circle, approaching the hut from the north. They then took up their positions on either side of the hut, facing out. The snake-men, about fifteen in number, then entered the court, marching in the same direction as the others had. As they passed the hut, they scattered some sacred meal, and stamped on a concealed board in front of the door. This board is buried in the ground, immediately in front of the door of the hut, and a hollow scooped out under the middle of it. Each performer, as he passes, scatters some sacred meal (which is a form of prayer), and stamps on this board, producing a loud, hollow sound. The object is to call the attention of the gods to the zeal of the performer, that he may be properly rewarded. By another version, if a dancer succeeds in breaking this board, which is nearly two inches thick, any wish that he may make for two succeeding years will be granted. As the same board is used continuously until it wears out, it must be occasionally broken. It is possible, however, that the man who gave me this version invented it.

After this stamping had been repeated four times, the snake-men formed a line, facing the antelopes, and about six feet distant from them. The antelopes then commenced a low chant, in which the snake-men joined. Occasionally the measure was changed for a few moments, and they made a gesture with the feather wands which each man carried in his right hand. The chant was kept up without intermission during the entire dance, and was accompanied by a peculiar rhythmical swaying motion of the body. When the feather-shaking had been repeated four times, the snake-men broke their line, and grouped themselves in front of the door of the hut. A moment later the group parted, and one of the performers appeared, holding in his mouth a snake. A companion (also a snake-man) joined him, passing his left arm over the first man's shoulder; and the pair passed around on the line previously pursued, with the peculiar step which, for want of a better name, is called a dance. The companion carried in his right hand one of the feather wands before referred to, consisting of two large feathers (said to be those of the wild turkey) mounted in a short wooden handle, with a small red feather dangling from the end. This wand was constantly and very skilfully used by the companion to distract the attention of the snake held in the mouth of the other, and to keep its head forward. The man who carried the

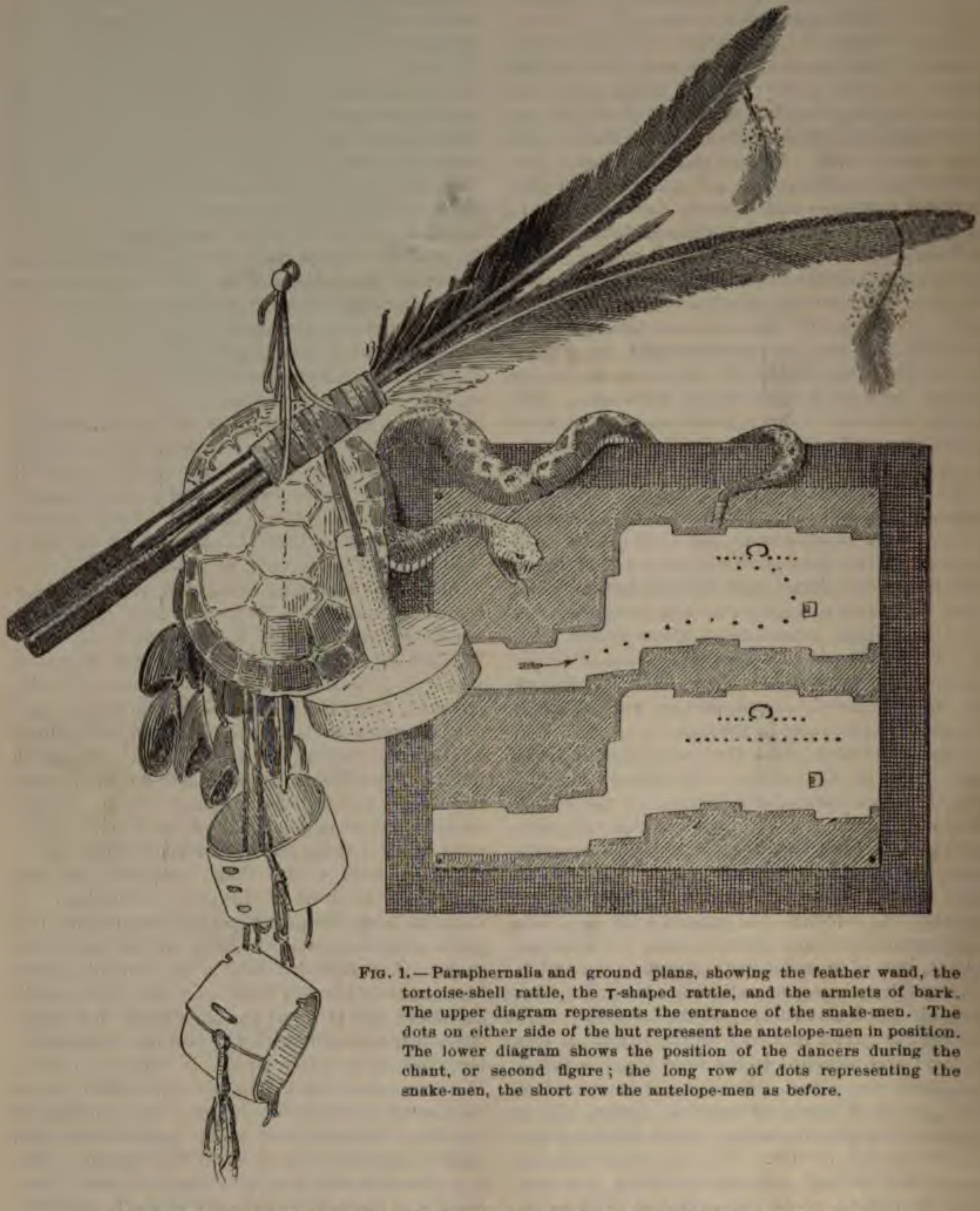


FIG. 1.—Paraphernalia and ground plans, showing the feather wand, the tortoise-shell rattle, the T-shaped rattle, and the armlets of bark. The upper diagram represents the entrance of the snake-men. The dots on either side of the hut represent the antelope-men in position. The lower diagram shows the position of the dancers during the chant, or second figure; the long row of dots representing the snake-men, the short row the antelope-men as before.

A SNAKE-DANCE AMONG THE MOKI INDIANS OF THE SOUTH-WEST.

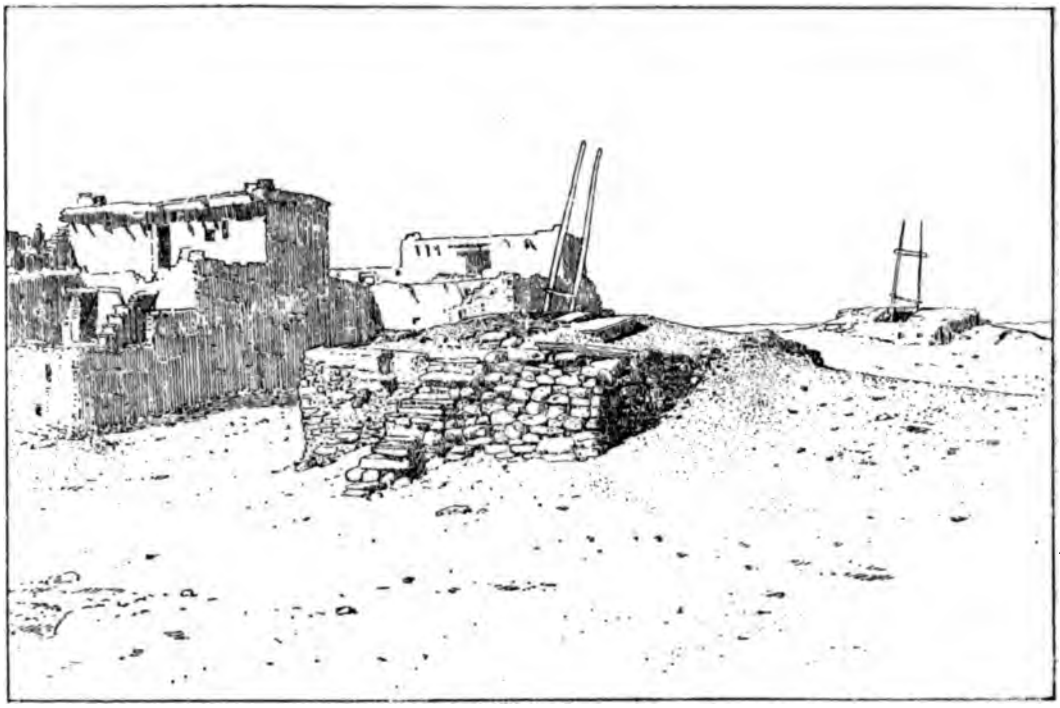


Fig. 2. — A Moki kiva.

Fig. 3. — The middle court of Mashongnavi, looking north.

snake carried nothing in his hands. I have been told that the men who took this part kept their eyes tightly closed during the whole performance. This, however, I did not notice myself, though these dancers were always led back to the hut when it was desired to procure more snakes. The snake is held in the mouth between the lips, not between the teeth; and the mouth is filled with some substance, resembling meal in appearance, to avoid biting the snake when the dancer becomes excited. When a snake became unmanageable, the dancer simply opened his mouth, letting it fall to the ground.

Each of the couples described was followed by a single man or boy, whose duty it was to pick up the snakes as they were dropped. These also carried feather wands. I shall hereafter refer to these as collectors. As the snakes were dropped haphazard, at any place, and at any time, and as they manifested a lively disposition to get out of the way as soon as possible, the position was hardly a sinecure.

This second figure of the dance occupied about twenty minutes; though, after the first round, the order became somewhat broken, the collectors being grouped in the centre, and darting here and there after snakes, while the dancers pranced around in an irregular circle. Each performer, as he dropped his snake, was led back to the hut by the companion for a new one; and this continued until the supply was exhausted. The low chant of the antelopes, the dismal though rhythmical clank of the tortoise-shell rattles, the peculiar motion of the dancers, the breathless attention of the spectators, — all gave this part of the performance a weird character.

The latter part of the figure, when the snakes had accumulated in the hands of the collectors, and the dancers became excited, was very interesting. One of the collectors had a dozen or more snakes in his hands and arms. When the number became too great for proper management, part of them were turned over to the antelope-men, who remained in line on either side of the hut, and were held in their hands until the final figure.

The final figure was the most exciting. One of the performers, going a little to one side, drew in sacred meal a circle about thirteen feet in circumference. Two diameters at right angles were drawn, and another line passing obliquely through their intersection, representing the cardinal points and the zenith and nadir. The latter are expressed by the line drawn from north-west to south-east.

The chant suddenly ceased, and all those holding snakes made a rush for this circle, and dropped them into it. The snakes formed a writhing mass, nearly filling the circle longitudinally, and about six inches in height, so nearly as could be distinguished, as the whole figure lasted but a few seconds. The snake-men then literally threw themselves into the circle. Each man seized as many of the reptiles as he could, and made off with them at full speed, through the passage by which the procession had entered, and through the other opening; and the public part of the performance was finished.

The snakes thus carried off were taken down to the foot of the mesa, and there released. On our way back to camp we met several parties returning from the performance of this duty.

The object of this part of the ceremony, as nearly as could be made out from the various descriptions which we received, was this: the snakes were released at the four quarters of the earth in order that they might find a rain-god (whose form is that of a gigantic serpent), wherever he might be, and tell him of the honor which his children had done him, and of the urgent need of rain among them. This is symbolized in the circle and cross lines before mentioned. The part of the heavens from which rain came indicated the region where the god was at the time that he received the message. This helps somewhat to explain the reverence, we might almost say fondness, which the Moki feels for the snakes. The released snakes act not only as messengers, but also as ambassadors, to the rain-god; and a snake which had been well treated would present the Moki's prayer much more forcibly than one which had been roughly handled.

Snakes of all varieties procurable were used, including the rattlesnake, about twenty per cent of the latter. Many of them were numbed from long confinement and frequent handling, though when given a chance to escape, as when they were dropped on the ground, they showed decided signs of life. A great rivalry is said to exist among the dancers as to who shall handle the largest and finest rattlesnakes; but, I must confess, I failed to see it. On the contrary, there seemed to be a preference for a small, thin snake, not poisonous (the whip-snake, I think). Several of the dancers held two of these in the mouth, and one man even had three. When a man happened to get a rattlesnake, however, he did not seem to mind it much; though, when a snake of this variety was dropped by one of the dancers, the collectors did not show any great eagerness to pick it up. Several of these rattlesnakes were in a very ugly mood, and, when dropped, immediately coiled themselves, sounding their rattles, and showing a disposition to fight. These were not picked up quickly, as the others, but were given a wide berth by dancers and collectors alike. One of the elder collectors,

more skilful or more rash than the others, would then approach, and tease the snake with his wand until it struck, the blow being received on the feathers. This would be repeated until the snake became frightened and attempted to escape ; but, as soon as it uncoiled, the collector would seize it with a quick movement of the hand from the tail toward the head, the snake being grasped by the neck. This movement is accomplished with lightning-like rapidity. The wand is retained in the hand ; and the feathers, during the operation, cover the snake's head. After the seizure, however, it seemed to make little difference how they held the snake, holding it by the middle or tail as often as by the neck. No one was bitten at this dance ; though at Wolpi, the next day, one of the young performers, a boy of eight, made the rounds with a rattlesnake fastened to one of his fingers. During the final scramble I lost sight of him, and was unable to discover what course of treatment he underwent, or whether he survived or not.

One of the striking accessories of the dance, are the groups of women in holiday attire, who stand along the walls and along the margin of the dancing-space, holding in their arms large trays of sacred meal, which they scatter on the performers and on the snakes as they pass. The boy who was bitten at Wolpi was almost covered with meal by these women.

At the second dance, at Wolpi, we were on the lookout for the after-proceedings, and had an opportunity of seeing a part of then. Immediately after the dance the women were seen coming in from all directions with baskets of *peki* or paper-bread, great quantities of wheat-bread or rolls, bowls of mutton-stew, and the various eatables which formed the Indians' holiday food. The quantity seemed sufficient for an army. These were sent down into the snake-*kiva*. In the mean time other women were scurrying along with great bowls of a brownish liquid with a very disagreeable smell. I followed several of these women around to the back of the pueblo, and there saw a number of the late dancers drinking this liquid, and vomiting most violently. I afterwards learnd from Weeki, the snake-priest, that this process continues for four days, — a period occupied in alternate feasting and vomiting. This is the so-called purification.[1]

[1] This is the way our interpreter translated it : it should be constantly born in mind, however, that the idea of purity — of moral goodness — is one which does not make its appearance until we get well along in the scale of development, to a point much beyond the position occupied by these Indians. The savage or barbarous mind recognizes no physical cause for phenomena. Poison, *as such*, is an idea which is wholly inconceivable : and death from that cause, from a snake-bite for example, would be attributed to some evil influence exerted by man, as in witchcraft or by a supernatural being, or to some mistake or omission in the incantation.

This number, 4, runs through the entire performance : four days are spent in collecting the snakes, — one day for each of the cardinal points of the compass ; the dancers retire then to the *kiva* for four days, fasting and praying during the day, and eating only one meal, and that one after dark ; on the fourth day of this period the dance takes place, and is followed by four days of purification and prayer ; each figure in the dance, except the last, is repeated four times.

A description of the Moki snake-dance which occurred at Wolpi in 1881 has been published by Capt. John G. Bourke of the army, in his book 'The Mokis of Arizona.' This description differs in many important points from mine. It is true, we describe dances at different villages ; but I have already said there was no essential difference between the two performances witnessed by us : in action the two dances were identical. As Captain Bourke's account is probably a close one, the ritual of the dance must have undergone many important changes in the period which elapsed between the dance witnessed by him and the one here described. The dance is performed under the auspices of the antelope gens or the antelope order, we were unable to determine which ; but the men who handled the snakes belonged to the snake order, and not to the snake gens. I think that one of the requirements is, that all those taking part in this dance shall be members, either congenital or adopted, of the antelope gens, or order, whichever it may be. The snake gens has nothing to do with the dance ; and, contrary to the opinion of Captain Bourke, it is not referable, I think, to ancestor-worship, at least not directly. It is not even serpent-worship, unless the word be taken in its widest sense, — the sense which includes not only serpent-adoration and reverence, but also serpent-symbolism. It is in this sense that I have used the word. The Moki Indian loves and reveres the snakes, and will never, unless under the greatest necessity, do them harm ; but he does not adore them, nor sacrifice to them as he does to his gods, but uses them simply as the most appropriate messengers to the rain-god.

The underlying ideas which have given rise to this dance are, and must remain so long as our knowledge is in its present incomplete state, unknown. From the point of view of the great majority of the Moki Indians, it is simply an invocation, — a ceremony having for its sole purpose the procuring of rain ; but the fact that there is an esoteric legend, one very jealously guarded, too, seems to point to another and a deeper signification. An investigation in this direction would probably result in throwing much light, not only

on this particular ceremony, but on serpent-worship in general. The rites connected with this form of worship have always been secret, — secret even in the tribe where it is found. And while the worship of the serpent has been associated with some of the highest conceptions of the barbarous and semi-civilized minds, — with, for example, the principles of reproduction and of the immortality of the soul among the Hindoos, and with the idea of divine wisdom among the Egyptians, — and while it has been so widely distributed, in one form or another, that there is hardly a nation or tribe which does not carry traces of it in its history, but little is known about its details or origin. The performance takes place every second year at the village I have named, and is ostensibly, as I have before said, for the sole purpose of procuring rain. I have been assured by several of the old men in Moki that this dance has never failed to do this; and, in fact in the present instance, it was preceded by several months of the dryest weather known in that country for years, and was succeeded, on the very day of the dance, by such copious and prolonged showers, that many of the Mokis lost their crops by washouts.

KOSMOS MENDELIEFF.

THE ARTICLE 'PSYCHOLOGY' IN THE 'ENCYCLOPAEDIA BRITANNICA.'

IN the eighth edition of the 'Britannica' the article on metaphysics covered seventy-four pages, and there was no article on psychology at all; in the ninth edition the article on psychology covers forty-nine pages, and that on metaphysics is reduced to twenty-three pages. This change in the apportionment of space to these two topics is a reflection of the change of base which has occurred in the study of the philosophical sciences within the last few decades. Psychology has become, or at least has plainly declared that it intends to become, strictly scientific; and metaphysics has withdrawn to a field of its own.

In an encyclopaedia article on such a topic the author has a bewildering choice of possible modes of treatment. The average reader, referring to an article on psychology, will perhaps expect a general statement of the results obtained in the different departments of psychological research, treated from a broad modern point of view, and perhaps some account of the history of past doctrines, and explanations of the similar topics. Such a reader will be disappointed in Mr. Ward's article on psychology. The article is a very puzzling one for a reviewer. To find fault with it, is simply to say that it is not the kind of an article which he himself would have wished for or have written, and, on the other hand, shows a neglect for the very learned and bright treatment which the subject receives at the author's hands. On the other hand, he cannot refrain from expressing the very unsatisfactory impression which the reading of Mr. Ward's work leaves upon him. In analyzing this disappointment, one would lay the blame either on the fact that the reader's expectation was wrongly founded, or that Mr. Ward had chosen to write an article which did not have practical utility as its chief aim, or more probable, perhaps, than either of the above two, that the present condition of psychology is reflected in this unsatisfactory, rather scattered treatment. Perhaps, after all, this is the real appearance of a cross-section of the science at the present moment.

Beginning with the argument that the peculiarity of psychology rests, not in its subject-matter, but in its point of view, he proceeds to develop a theory of presentations which is fundamental to his whole treatment. Then, under seven or eight headings, he treats such subjects as perception, imagination, association, feeling, self-consciousness. But under each section the reader finds himself at once *in medias res*. No general outline of the topic is given, or of its connection with other subjects. The author is evidently perfectly at home in the literature of the topics; but only here and there, by way of illustration, are the results of recent experiments in this field brought in. The section on feeling is recommended as especially well treated.

He then develops the theory "that there is pleasure in proportion as a maximum of attention is effectively exercised, and pain in proportion as such effective attention is frustrated by distractions, shocks, or incomplete and faulty adaptations, or fails of exercise, owing to the narrowness of the field of consciousness, and the slowness and smallness of its changes."

In a general review of this volume of the encyclopaedia a writer referred to the article as the most abstruse article in the volume. This abstruseness seems to come from the fact that the author has given a series of minute dissections, but neglected to give the relation of the different parts which were under the knife. He has used the microscope without describing the naked-eye appearances.

THE replacement of a diseased eye by the healthy eye of an animal has now been done five times, with one success, says the *Medical record*. In the four cases the cornea sloughed; in two however, firm vascular adhesions took place.

SCIENCE.

FRIDAY, JUNE 11, 1886.

COMMENT AND CRITICISM.

IT WILL BE REMEMBERED that in the month of May a gentleman in Brooklyn died from hydrophobia. His medical attendants, competent physicians, had no doubt about their diagnosis, and his symptoms were characteristic of that disease. Confirmatory of this opinion, the autopsy revealed no lesion to which could be attributed the symptoms from which he suffered, — a condition which is also characteristic of hydrophobia. Portions of the brain and the spinal cord were carefully wrapped in cloth wet with a solution of bichloride of mercury and sent to Dr. Sternberg. Small portions of these were thoroughly mixed with sterilized bouillon; and this broth was then, by means of a hypodermic syringe, injected under the dura mater covering the brain of a rabbit, a small button of bone having been first removed by a trephine. The wound was then closed by sutures. Three rabbits were thus operated upon. One died at the end of twenty-four hours as the result of the operation; hydrophobia, of course, having nothing to do with it. Another is now, after eighteen days, apparently well. The third one, on the sixteenth day, commenced to show signs of being ill: he was disinclined to move, and in a few hours evidences of paralysis appeared, at first in the hind-legs, and subsequently in all the extremities. On the 5th of June, the eighteenth day after the operation, he died. The wound had healed, and there were no evidences of inflammation. The brain showed no softening at the point where the inoculation was made, no pus, nor any evidences of inflammation either of the brain substance or of its membranes. The cord also appeared normal. Portions of the medulla of this rabbit were immediately mixed with sterilized bouillon, and two rabbits were inoculated in the same manner as has been described. This case is of great interest as being, so far as we know, the first animal in this country to become affected with hydrophobia from inoculation with material taken from a person who died from that disease. If Dr. Sternberg is as successful with these rabbits as with the first, there is no reason why the series cannot be continued, and thus the protective virus of Pasteur be obtained in this country, and a trip to Paris by the victims of dog-bites made unnecessary. As we go to press, we learn that the second rabbit, mentioned above as remaining unaffected for eighteen days, shows unmistakable signs of hydrophobia.

IN THE GREAT POLITICAL changes of last December, the Department of public works of Japan was abolished, and the Engineering college hitherto conducted by that department was transferred to the Department of education. Early in the present year, the Engineering college was amalgamated with the University of Tōkyō, and the resulting whole was instituted as the *Imperial university* by the decree of March 1, as mentioned in our last issue. As at present constituted, the university consists of five colleges; viz., those of law, of medicine, of engineering, of literature, and of science. Of these, four are located in the Kaga-yashiki (the former 'yashiki' of the Daimio of Kaga), while the fifth, that of engineering, finds its quarters in the buildings of the former Engineering college. This amalgamation must be looked on as but another stage in the development of that institution which began in the days of the Tokugawa shōguns as the place for teaching, and examining into, western books, and which has been steadily growing, ever since, under various names, such as Kaisei Gakkō, Tōkyō Daigaku (University of Tōkyō), etc. In the imperial decree of March 1, referred to above, the prosecution of original investigation has received recognition hitherto not accorded to it; for Art. 1 of the decree says, "The Imperial university shall have for its objects the teaching of such arts and sciences as are required for the purposes of the state, and the *prosecution of original investigations in such arts and sciences.*" This must be considered as a decided upward step. In the new institution, different colleges have also more power to act independently according to their own wants than before. The very ponderous official machine through which the business of the university had to be transacted is somewhat simplified; and professors, in the science college, for instance, are given more freedom in the management of their own laboratories.

Many Americans who have been in Japan will learn with regret that Mr. H. Katō, who has been in the responsible position of the president of the university for the last nine years, is no longer connected with the university, having lately been transferred to the senate (Genrōin). During his presidency, the university grew up from a very insignificant institution to be one of the great seats of learning in the world. Mr. Katō's services will long be remembered in the university. The president of the new Imperial university is Mr. H. Watanabe. He has occupied with success many positions of responsibility under the government, and was latterly very popular as the mayor of Tōkyō. His appointment to the university is considered by all to be eminently fitting.

MR. GOODRIDGE has another article in a recent *Scientific American* on 'Modifying the climate by closing the Straits of Belle Isle,' in which, as before, his argument is based on the error that the great body of the Labrador current comes to us through these straits instead of around the eastern coast of Newfoundland. He gives no evidence in support of this assertion, but vaguely discusses the question of the origin of ocean-currents, which has nothing to do with his climatic problem. Referring to the objection pointed out in *Science* some months ago, that our cold weather comes from the west and north-west, he grants that this will 'sometimes occur,' as if it were exceptional. He thinks that "if we had not the cold wall between our shores and the Gulf Stream, it is fair to presume that we should have a less stormy coast." This presumption is very questionable indeed; for in winter, when most of our notable storms occur, they do not originate on the coast, but come from the far west and south-west; and, moreover, in the winter season, the contrasts in temperature along our shores would be stronger if the warm Gulf Stream flowed close along the cold land. As far as this contrast is effective, our winters would be more stormy then than now.

THE SCIENTIFIC COMMISSION REPORT.

THE long-looked-for report of Mr. Allison's commission on the surveys has at last been completed, and submitted to congress. It proves to be even more conservative than was indicated in the summary of the views of the commission, which was given in our issue of May 7. At that time the members of the commission were all of opinion that the operations of the geological survey should be restricted by law in the direction indicated by Mr. Herbert's bill. The majority, comprising Messrs. Allison and Hale of the senate, and Messrs. Lowry and Wait of the house, now frankly admit that the statements and arguments of Major Powell have led them to modify their views, so that they no longer propose any restriction upon the paleontological or other work of the survey. They therefore propose, in lieu of Mr. Herbert's bill, one which only requires that the printing of the survey shall be specifically estimated for, — a provison to which no one will object, and which ought to be extended to other bureaus of the government. The following sentences from the report embody the gist of its judgment upon the work of the survey: —

The commission is of opinion that the administrative part of the bureau is well conducted and with economy and care, and discloses excellent administrative and business ability on the part of its chief.

The commission expresses no opinion as to the plan of the survey as delineated by the director, as it does not regard itself charged with this duty, nor is it competent to express an opinion on a subject involving so difficult a scientific question. This, in the judgment of the commission, must be left to the criticism of those who are able to do so more intelligently than can the commission, with its limited means of knowledge.

The commission has no doubt of the wisdom of a geological survey of the whole country, and considers the question as to the propriety of its being done by the general government as settled by existing legislation.

In treating of the coast survey, the commission gives an outline of its history from its inception in 1807 until the present time. The report treats at length of the feasibility of transferring the survey to the navy department, and shows that only a small part of its work is of a kind with which naval officers are legitimately concerned. It also speaks with favor of the geodetic work of the survey, sees no occasion for any other legislation than can be incorporated in the appropriation bills, and concludes that the secretary of the treasury can make all necessary regulations governing it.

The report on the signal service will disappoint all who have been dissatisfied with General Hazen's management. It recommends no legisla-

tion changing the general administration of the office, unless the proposed abolition of the 'study-room' and of the school at Fort Meyer be considered such. The commission says that any intelligent young man of good education can learn every thing necessary to the practical work of an observer in six weeks, and sees no occasion for so elaborate a scheme of instruction as that provided. It is not, however, intended to dispense with the services of the able meteorologists who have been employed by the office.

On the question of the military control of the meteorological service, the report is extremely mild. It is found that the work is in no sense military, and that military discipline and law are not necessary to its efficiency. If the question were a new one, whether a civilian bureau with a civil head should be established rather than an extension of a military bureau, the commission would recommend this rather than a military organization. As the matter stands, the commission is equally divided on the question of leaving the service in its present hands. Three do not see why it cannot be as well managed by the chief signal-officer of the army as by a civilian head; three think such a head necessary to its efficiency. All, however, are in favor of cutting down the military staff as it now exists. As with the other bureaus, the commission does not find that congress can advantageously define the operations of the signal-office by other legislation than such limitations as may be imposed on expenditures in framing the appropriation bills.

The principal minority report is signed by Senator Morgan and Representative Herbert. It consists largely of severe criticisms upon the work of both the coast and geological surveys. The topographical system of the coast survey is strongly condemned on the score of extravagance in delineating minute features of no use whatever to the navigator, and of little or no use to any one else. It favors the transfer of the office to the navy, and would abolish entirely the further prosecution of other geodetic measurements than are necessary to map-making.

Such are the main points of the report. Comment is unnecessary, because there is no reasonable chance of legislation on the subject. The surveys will be left, as they have heretofore been left, in the hands of the appropriation committees. It is expected that the house committee will sympathize with the minority rather than the majority, so far at least as the coast survey is concerned, and will therefore be disposed to reduce the appropriations to the lowest limit, and perhaps cut down the force also.

HATCHING, REARING, AND TRANSPLANTING LOBSTERS.

THE experiments of Dannevig in hatching the ova of the European lobster, naturally awakened an interest in the propagation of the American species, which, as has been shown by Mr. Rathbun, is becoming less abundant on what were formerly the best lobster-fishing grounds on our coast. This depletion of the supply of lobsters is very probably due in large part to the fact that vast numbers of females are annually caught and killed, together with the many thousands of eggs hanging to their abdominal legs. It happens in this way that not only the individuals most directly concerned in reproducing their species are destroyed, but that almost countless millions of partly developed young are also sacrificed, in the ordinary process of supplying the markets with this crustacean.

Recent experiments under the direction of Capt. H. C. Chester at the U. S. fish-commission station at Wood's Holl, Mass., have demonstrated that it is possible to hatch the ova of the lobster in unlimited quantities in the same device in which the ova of the cod were successfully hatched last year. The eggs, at any stage, may, in fact, be removed from the parent female without injuring her, or an appreciable number of ova making up the masses of eggs hanging to her swimmerets. The eggs, if then placed in the hatching-apparatus, will develop and become embryos, which will free themselves from their investing envelopes in due course of time. The length of the period of incubation is not known, as artificial fertilization of the eggs of this creature is not practicable; though with greater experience, and a wider range of accurate observation, it may soon be possible to state the length of that period pretty accurately. The approach toward the completion of development in the egg is marked by the gradual diminution in the bulk of the yelk, as a result of which the eggs become more and more translucent; so that, by the time they are ready to hatch, they are dirty-yellowish in color instead of dark greenish-brown as at first. At the same time the ova become larger by about one-half their original diameter. Towards the close of the period of development, the eggs also lose their original globular form, and become decidedly oval. During the later stages of development the eggs show

a great range of variation in color, a few being bright crimson-red, while the majority are of a dirty greenish-yellow tint. Similar variations in color are apparent in the young after hatching, and are apparently due, as in the case of the eggs, to the presence of an unusual number of red-pigment cells.

Immediately after hatching, the young swim about in the sea-water, and will at once begin to feed, even killing and eating each other if food is not soon offered them. Minced crab or lobster meat is greatly relished. The recently hatched lobsters are also attracted by the light, and will always collect at the side of the aquarium or tank nearest the source of light. At night, or if the light is shut off, the young lobsters go to the bottom of the tanks; and it seems that they may then be most actively engaged in feeding if food is placed within their reach.

When first hatched, the young lobster measures one-third of an inch long, and is provided with cephalothracic appendages only. The tail, unlike that of the just hatched crayfish, is without swimmerets. The five thoracic appendages, unlike those of the adult or those of the young crayfish, are biramose, the outer branches or rami being flattened, and fringed with plumose setae. These outer branches of the limbs are rapidly vibrated to and fro, and constitute the principal locomotive appendages of the young lobster during the pelagic stage of its existence, acting like paddles or oars and independently of the inner rami, which are used mainly as prehensile organs. The inner rami of the appendages afterwards become the permanent thoracic limbs, while the outer ones abort.

When from four to six days old, they moult for the first time; and it is noticed that in doing so they suddenly increase in length and bulk, since they now measure nearly half an inch in length. They also, at this time, acquire four pairs of abdominal legs or swimmerets; but the telson is still formed of a broad, single, triangular piece, emarginate posteriorly, and not rounded and serrated behind as in the young crayfish. The pincers of the first pair of thoracic limbs become distinctly developed at the first moult.

It is obvious, from what has preceded, that the lobster passes through a schizopod stage, as pointed out by S. I. Smith. This stage has been omitted in the ontogeny of the crayfish. The young also evidently abandon the mother lobster at once, the blades of their pincers being without hooked tips for clinging to the mother, as in the recently hatched crayfish.

In the course of about eight days more, the young lobsters probably moult again, — a process which is repeated for the third time in the course of perhaps ten days more, when they will measure about five-eighths of an inch long, and when they have acquired an additional pair of appendages, so that they then have all that are possessed by the adult.

The young lobster probably moults twice more before it is sixty days old, by which time its antennae become fully developed and flagelliform, while its telson loses its larval form, and the animal has thus completed its metamorphosis. It now measures about an inch in length, and is occasionally taken at the surface in a tow-net, though it is probable that it now usually remains at the bottom, concealing itself among the seaweeds and stones, lying in wait for its prey.

Recent experiments conducted by Captain Chester, at Wood's Holl, have demonstrated that it is possible to keep the adult lobsters alive for an indefinite period in a moist, cold atmosphere. These conditions may be most readily satisfied by packing the lobsters between layers of wet seaweed in a metal box with a perforated cover; this metal box being then placed in a larger wooden box, and surrounded with cracked ice, which will cool the contents of the inner box down to 45° F. At this temperature, in this device, lobsters have been kept alive and in good condition for fifteen days, and in a moist atmosphere only; their gills not having been immersed in water during the whole period. Even the eggs hanging to the swimmerets of the females so treated are not injured in the slightest degree, and will continue to develop normally if put into the hatching-jars. The adults also, if taken out of the seaweed in the metal box, and put into sea-water, have the moist air in the gill-chambers at once replaced by the water, and begin to move about as if nothing had happened to them.

This important discovery renders it possible to transport living adult lobsters across the continent, and to stock the waters of the Pacific coast with this important crustacean. It is also possible to pack the eggs in seaweed in a similar manner, and transport them for long distances, after which they may be hatched and reared up to an inch in length by artificial means. This will render it possible to collect lobster-eggs to the number of many millions at several points over the fishing-grounds, and bring them to a great central hatching and rearing establishment, such as that at Wood's Holl, where at least a hundred million eggs may be cared for at one time. The work of propagating the lobster, the cod, and other fishes, will then keep the station at Wood's Holl in practical operation, in an economic direction, for the entire year. The recent successes at

this station, in artificially hatching the mackerel and tautog, indicate that the application of the methods of artificial propagation are capable of still further extension. At present the propagation of the lobster is of the greatest practical importance; and the possibility of feeding and caring for the young in large quantities till they have attained the length of one inch, when they practically abandon their pelagic habits and are able to take care of themselves, seems to be assured. JOHN A. RYDER.

ROYAL GEOGRAPHICAL SOCIETY.

THE anniversary meeting of this society was held on Monday, May 24, with the president, the Marquis of Lorne, in the chair. The report of the council showed that 178 fellows had been elected during the year, besides three honorary corresponding members. The losses had been, by death 63 (besides one honorary corresponding member), by resignation 75, and by removal 21, making the net increase for the year 16. The total number of fellows on the list, exclusive of honorary members, on May 1, was 3,407.

The president said he considered himself most fortunate in that it was his duty to present to Mr. Phelps, as the representative of America and of his distinguished countryman, Major Greely, the queen's medal for this year. It was the sixth occasion on which a president of that society had greeted the achievements of a citizen of the United States with that honor. In the year 1855 it was accorded to Dr. Kane, who had charge of the expedition generously fitted out by the republic to search for Sir John Franklin. Again, in the year 1867, Sir Roderick Murchison, then president, was able to place in the hands of the American minister the gold medal given to another of his countrymen, namely, Dr. Hayes, who had reached a more northern point of land than any before attained. Dr. Hayes had himself been the companion of Kane, and was the discoverer of that very land, named after Henry Grinnell of New York, which had been the scene of the explorations of Major Greely.

The president then presented the patron's medal to Signor Guido Cora (*Science*, May 28).

The Murchison grant for 1886 was awarded to the brothers F. and A. Jardine, for their remarkable journey overland to the settlement of Somerset at Cape York (Queensland) from May, 1864, to March, 1865, during which they solved the question of the courses of the northern rivers emptying into the Gulf of Carpentaria, and definitely ascertained the area of the York Peninsula adapted for pastoral occupation.

The Back grant for 1886 was then awarded to Sergeant David L. Brainard, in recognition of the effective services rendered by him during the various explorations carried out by the American Arctic expedition of 1881–84.

The president remarked that the active work of the society during the past year had been largely directed towards initiating improvement in geographical education.

The report of the society's inspector, Mr. Keltie, describes the results of Mr. Keltie's visits to universities and schools at home and abroad for the purpose of inquiring into the position of geography in education: it had attracted much attention at home and abroad, and, it was believed, had been productive of good results. The interest excited by the society's recent action had been so great, and the expectation that they should continue it by taking some positive steps towards encouraging improvements in the position of geography in schools and universities was so general, that the council had felt encouraged, and indeed bound, to carry the scheme further. The educational committee of the society therefore made certain suggestions to the council, which were now under consideration. and would probably be adopted. The principal of these suggestions related to the appointment of a lecturer in geography, to deliver courses where the council might direct.

In order still further to encourage the scientific study of geography at the universities, the committee suggested that a prize or travelling scholarship should be given every alternate year to a student who had shown marked ability in geographical subjects, and who might desire to visit one of the less-known districts of Europe, or the Mediterranean or Black Sea shores, and any results to be communicated to the society. One or other of the annual grants which were at the society's disposal might be devoted to this purpose.

Another suggestion was aimed at reaching the intelligent middle and working classes through the medium of the university extension scheme. For this purpose a small annual grant was proposed. Another was that a medal be given by the society to the student reported by the examiners to have done best in physical geography in the first part of the natural sciences tripos (honors examination).

And finally, in order that all classes of schools might be reached, it was proposed that prizes be offered for competence in geography to the students at the various training-colleges. Here they reached the fountain-head of education; and, if they could secure adequate attention to geography in the institutions which sent forth yearly troops

of teachers to the board and elementary schools, the society would have accomplished much. It was perhaps characteristic of the absence of theory in the proceedings of the practically minded average Briton, that they who had done more as a nation to explore and colonize the distant parts of the world than any six other nations should have at home less instruction given in our schools on the subject of geography than was enjoyed by the youth of most of the European peoples.

The belief was expressed that the work of discovery had recently been aided by the Indian army in Burmah, and by the impulse given by Australia to the exploration of New Guinea.

The death of the British commissioner might have temporarily checked measures that would lead to the investigation of this latter country; but they might trust to the enterprise of Ford and other explorers, and to the activity with which Australasian commercial interests were pushed, for additions to our knowledge of an island of which it must with some shame be said that a few birds of paradise had hitherto represented its available export trade. With Baron von Müller as president of the Melbourne branch of the Australasian geographical society, they might be sure that the scientific aspects of the investigation of this magnificent new field would not be overlooked.

In Canada, again, Selwyn and Dawson and Macoun had been engaged in marking the value to science of the recent discoveries in geology, mineralogy, and meteorology made possible by the rapid completion of the Pacific railway across hitherto unknown mountain-ranges, whose ridges were the birthplaces of waters flowing into the Arctic, into Hudson's Bay, and the Gulf of Mexico. So valuable were the storm-signals to be derived from stations in the far north-west, that the American government had gladly placed the observations of nearly ninety stations at the disposal of the Canadian government, in return for those from about twenty in the British dominions.

The messages flashed from Toronto and Washington over the American continent and across the Atlantic had already been the means of saving many thousands of lives, and afforded the most practical recent proof of the immediate utility of scientific induction. The western points at which records were kept were spots wholly unknown to the geographer a century and a half ago.

There are few among our race, whether belonging to the nation of their gold medallist, Greely, or to their own, who would not place a higher value on the discoveries in that north-western land than on those which should open to them access to the torrid zones. They gladly recognized the gallant efforts made by other races, notably by the Italians; and, while they gave the gold medal to him whom they might almost call their countryman, they were glad to recognize the aid given to their science by Signor Cora, and they condoled with Italy in the recent loss of the leader and members of the expedition recently massacred near Aden.

Having briefly reviewed the chief geographical events of the year, the Marquis of Lorne concluded by saying that the mere string of notes, telling of what in a twelvemonth had been accomplished, showed how quick was now the invading march of knowledge.

A FINAL BUFFALO-HUNT.

THE National museum has sent its chief taxidermist, Mr. William T. Hornaday, on a hunting-tour through the far west, for the purpose of obtaining specimens of the buffalo, before this animal becomes extinct in this country. Mr. Hornaday took with him as an assistant Mr. A. H. Forney, an attaché of the museum. The party reached Miles City, Montana, May 12. Some Crow Indians are said to have killed four buffaloes on the Mussel-shell River about six weeks ago. It is firmly believed by many good authorities that there are not now more than from fifty to one hundred buffaloes in the whole of Montana, outside of the National park, where there are probably from two hundred to three hundred head. Hunters lie in wait outside the limits of the National park, waiting for these animals to cross the line, when they lose no time in despatching them as soon as possible. A stampede may occur at any time, which may result in all the buffaloes now in the park leaving; and if such were the case, very few, if any, would escape.

Mr. Hornaday and his party were received by the commanding officer at Fort Keogh, and furnished with a six-mule team, a driver, and escort. The plan of route is to cross the Yellowstone at Miles City, proceeding up Sunday Creek and Hunter's Creek to its source; thence across to Big Dry River, following it down to the Big Bend; thence across and westward up Big Timber Creek; and eventually across to the Mussel-shell River, which it is proposed to explore almost its entire length. This route probably covers every chance for finding buffaloes in Montana or elsewhere. There is said to be a small herd of from eight to twelve buffaloes in south-western Dakota. This region is a vast, level, treeless prairie utterly

destitute of wood, and it is Mr. Hornaday's opinion that an attempt to find these few would be hopeless. Skins of buffalo-heads are now valued by taxidermists in Dakota at fifty dollars each, from which it may be assumed that they have given up all hope of procuring any more.

Should this endeavor be fruitless, the suggestion has been made that buffaloes may still be obtained in the British possessions.

PARIS LETTER.

THE town of Montdidier (department of Somme), in the north of France, has recently held a series of festivals in honor of Parmentier, who, as is well known, was the first who brought that humble but useful vegetable, the potato, into France. It was in 1786, or thereabout, that Parmentier obtained from Louis XVI. permission to cultivate potatoes in the Plaine des Sablons, near Paris, to show what service could be expected from the new food. The festival of Montdidier consisted of an agricultural exhibition, an exhibition of horses and dogs, and of farming implements, and also of a meeting at which were discussed the names by which the different varieties of potatoes are to be designated hereafter. M. Chevreul was to preside, but could not attend. He wrote a letter, in which he said that Montdidier was for him a second birthplace, "because there was born Mlle. Sophie Davalette, whom I married in 1818, and who made the happiness of my life during nearly half a century." This is certainly a very interesting fact, but has not much to do with Parmentier.

Some days ago there was held in the palace of the Trocadero a festival for the benefit of the Pasteur institute. The very first artists, dramatic and musical, offered their time and talents: and the meeting was a success. The house, which is enormous, was crowded, although prices were high; and after the recital by Coquelin, of some verses of E. Manuel, a very fine ovation was given to Pasteur. He was very pale and much overcome. The whole audience rose, and cheered with all their might. This festival was got up under the direction of Scientia, a young scientific society founded by Charles Richet, G. Tissandier, and Max de Nansouty.

Dr. Lagneau has recently presented his report on the principal epidemics of Paris during 1884. (This is an annual report sent to the Conseil d'hygiene.) Some interesting facts are to be noticed in it. It has long been thought and said that typhoid-fever is the most prevalent and most fatal of Parisian epidemics. This, however, is quite untrue: diphtheria is entitled to the first place in the scale. Typhoid-fever, small-pox, and whooping-cough are becoming more rare than formerly. In 1884 there were 2,592 deaths from diphtheria. Dr. Lagneau's report is a very interesting and useful one, and indicates great progress in the hygienic and sanitary conditions of Paris.

A few days ago I was present at the inauguration of the Exposition d'hygiene urbaine, a very interesting display indeed. I specially noticed a hot-air room for the disinfection of mattresses and clothing (for military and colonial purposes), Redard's method for disinfecting wagons and railway-cars by over-heated steam, etc. The number of implements exhibited is very great, and one might spend many hours in the exhibition without feeling a decrease in interest. It is impossible to enumerate the useful and ingenious apparatus to be seen, and I shall not attempt it.

There has been a very sharp discussion in the Academy of medicine between Pasteur and Béchamp. It is pretty well known that Béchamp has got up a theory on microzymas, which nobody save himself well understands. Microzymas, according to his idea, are molecular granulations which have existed since the beginning of the world, — he does not say which day of creation, — and are possessed of eternal life. But what is the *rôle* of these microzymas, what is their influence on health and disease, what is their use and their *modus vivendi*, nobody knows. In short, M. Béchamp having attacked Pasteur's experiments with unusual fury, Pasteur arose and said that such discussions were entirely useless, and that the only thing to do was to begin experimenting again, and that M. Béchamp would surely recognize his errors if he only took care to experiment seriously. Pasteur contested every result of Béchamp's experiments, and asked for the appointment of a commission to examine the facts and arguments on both sides: he wants to have done with the microzymas, and to show where the errors lie. We shall certainly have some very interesting discussions soon. The commission has been appointed on Professor Trélat's proposal; and it is believed that M. Béchamp's last idea, viz., that microzymas transform themselves into bacteria, bacilli, and other pathogenetic organisms, will not live much longer.

The statistics concerning rabies in animals during 1885 have just been published. They show that in Paris, or rather in the department of the Seine, the number of rabid animals was 518. Of these animals, 503 were dogs; 13, cats; and 2, horses. Nineteen persons have died of rabies. It should be remarked that the number of cases of rabies in animals was much larger in 1885 than in 1884, — 518 instead of 301, an increase that is not easily accounted for.

I have recently attended three very interesting *séances* given by Professor Luys concerning hypnotism. The meetings were held at his private residence, and were attended only by some personal friends and acquaintances of Dr. Luys. The results of the experiments were very singular indeed, especially during a somnambulistic trance. M. Luys has studied, and showed to us, the effects of different drugs and poisons when put in a glass vial, firmly sealed with the lamp, and kept near the patient (*action des médicaments à distance*). Each different drug produces a special and characteristic effect. Valerian does not act like ether or brandy. Wine, brandy, and champagne do not produce exactly the same effects; that is, the drunkenness brought on by the presence of these different alcoholic beverages is not precisely the same, and the differences closely correspond with those observed in persons really intoxicated with wine, brandy, or champagne. For instance, ether acts on Esther N. in the following manner. After a few minutes' application of the ether-vial behind the neck, she grows less drowsy, opens her eyes, and begins laughing and grinning without any reason whatever. Her mirth is soon very great, and even noisy. A very singular fact is that in her normal condition many colors are not seen by her; but under the influence of ether she sees them quite distinctly, and is astonished at the vividness of her color-impressions. Valerian acts upon her very differently. She begins scratching the floor, as cats do, and believes she is disinterring the remains of her mother; and she is in a very sad train of thought. Wine, similarly put behind her back, intoxicates her in a most pronounced and realistic manner: she is certainly in a state of beastly intoxication, and could not possibly be more so if she had really swallowed several bottles of wine. It is quite a sight to witness the experiment. She goes through the whole ordeal from beginning to end, and finally rolls on the floor as drunk as drunkard ever was. Water brings on symptoms of hydrophobia. These experiments fully confirm those of Drs. Burot and Bourru, of Rochefort, on the same subject.

Near the end of last month, during the Easter holidays, the Congrès de sociétés savantes began its meeting in the Sorbonne for the twenty-fourth time. After having been made up entirely of provincial scientists, this society has recently enlarged its membership, and now comprises members from all parts of France. The number of persons who attend this meeting is always very great; but the Parisian members are rather scarce, especially when the weather is as fine as it has been this year, and tempts them to go and seek in some nook of Compiègne or Fontainebleau forests a week of leisure and rest after a winter of hard work. However, the meeting was very interesting. In the section devoted to economical and social science, presided over by M. Levasseur of the institute, many questions were discussed concerning property, the share that can be given in benefits to workmen, the Torrens act, and similar plans for the *mobilisation* of property, etc. In the historical and archeological section many papers were presented, as usual. These literary scientific studies are the ones that interest the greatest number of members; since these sections are the original society itself, which has only of late added sections for the study of natural history, mathematics, chemistry, and physics.

Apropos of societies, the Association française pour l'avancement des sciences has just published the first part of its report on the Grenoble meeting of 1885. This report is now published in two parts, separately bound as usual: it is published with great care, and is very large.

Professor Duclaux published last week a new edition of his book, 'Ferments et maladies,' under the title of 'Le microbe et la maladie.' It is an entirely new work, and gives a very good account of the facts at present positively known concerning the pathogenetic properties of different bacteria and bacilli. We recommend this book, which is very interesting and well written, although with too many attempts at literary effect.

The Institute of France has been recently called to elect a member in the place of Professor Bouley, deceased some time ago. There was only one candidate of sufficient notoriety and fitness for the place, and this was Professor Chauveau of Lyons, the well-known veterinarian and physiologist. He was elected by a great majority, and is to fill the place of M. Bouley in many ways, being already inspector-general of veterinary schools, and member of the institute, and soon to be elected a professor in the Museum d'histoire naturelle, in M. Bouley's place. His duties will be different from those of his predecessor. He will be professor of general physiology and pathology, instead of professor of comparative pathology, at least it is rumored so; and this is not surprising, Professor Chauveau being by training more of a physiologist than of a pathologist. He is a very able man, has worked a good deal, and thoroughly understands comparative anatomy and physiology. His election in Bouley's place is very favorably commented on here.

M. Laurent has communicated to the Academy of Belgium the results of some experiments on the influence of different bacteria on the growth of

Fagopyrum. He has grown the plant in different sorts of earth, and has found that the bacteria are very useful; since the plants grown in earth filled with bacteria are much bigger and finer than those grown in sterilized *humus*.

The last two numbers of the *Revue scientifique* contain articles on the zoölogical stations of Cette and Concarneau. The laboratory of Cette is well known, and presents the great advantage of a rich fauna to be found in the brackish waters of pools in the salt-marshes, and in fresh water. No place in France offers such a happy combination of different fields for biological students. Professor Sabatier of Montpellier, well known by his numerous and interesting researches on the origin of sexual elements in the vertebrates, founded this laboratory, and he now wishes to develop it. He is trying to raise the money for the purchase of a strip of land, and especially for a new building. It is to be hoped that he will succeed. As to Concarneau, the oldest of all our marine laboratories, it seems to be in good order. It was founded by Costi in 1859. It is a small laboratory, and cannot compete with its younger companions of Roscoff, Banyuls, Cette, Villefranche, and Wincereux; but yet it may render good service. Interesting researches concerning the temperature of the ocean at different depths have been conducted by M. Goïz; and it is intended to study the habits and biology of sardines, a fish very abundant on the coast at certain times of the year, and concerning which very little is yet known. V.

Paris, May 19.

NOTES AND NEWS.

THE provincial assembly of San Paulo has voted an appropriation of fifty contos of reis (equivalent to about twenty-five thousand dollars) to begin a geographical and geological survey of that province on the plan followed by the surveys of the territories of the United States; and work has already been commenced with the following corps: Prof. Orville A. Derby, director; Dr. Theodoro Sampaio, chief topographer; Dr. Luis Felippe Gonzaga de Campos, and Dr. Francises de Paula Oliveira, geologists. The first work of the commission will be the exploration of the river Paranapanema from near its source to its junction with the Parana, which promises to become an important link in the system of internal communications of the empire, and to afford a complete geological section across the various belts of sedimentary formations of the province. The province of San Paulo joins that of Rio de Janeiro on the south, is one of the most interesting and important of the empire, and has as yet received but little attention from geologists. It is very extensive, is known to possess great natural resources, and embraces the principal coffee-growing sections of Brazil. Operations have probably been begun by this time. With respect to his recent studies in Brazil, Mr. Derby writes, "I have been giving a great deal of attention to petrographical work, with very encouraging results, as I find that the geology of the vicinity of Rio de Janeiro is not so monotonous as I had supposed, as there are within easy reach of the city three ancient volcanic centres, with a great and perplexing variety of eruptive rocks, both in large masses and in small dikes."

— The belief in the occurrence of 'sea-serpents' in the ocean of to-day, though hardly openly averred, is not discountenanced by not a few scientific men whose opinions are entitled to the highest consideration. Dr. J. B. Holder, after giving (in the Annals of the N. Y. academy of sciences) an historical account of a 'sea-serpent' observed near Boston, corroborates the adduced testimony by the description of a carcass of a large and unknown animal found off the coast of Florida, as related by highly creditable witnesses. The creature described was over forty feet in length, and nowhere of more than two feet in diameter. Unfortunately the specimen was in an advanced state of decomposition, and no portion was saved. The discovery of the giant squids off the Atlantic coast within recent years demonstrates the possibility of other large animals yet inhabiting the ocean, of whose existence science is yet wholly unaware. May not some descendant of the cretaceous mosasaurs or plesiosaurs yet be among them?

— At a meeting of the Royal colonial institute, held on May 11, in London, a paper on 'Tasmania as it is,' was read by Mr. W. L. Dobson, chief justice of Tasmania. As to the chief industrial pursuits of Tasmania, Mr. Dobson remarked that the largest return was received from sheep's wool, and great attention was devoted to breeding merino sheep, with fleeces of the finest and densest quality. An inexhaustible supply of timber of different kinds was obtained from the dense forests of the island; and hops, oats, and potatoes were among the vegetable produce. There could be little, if any, doubt that the mining wealth of Tasmania was yet in its infancy. As to means of locomotion, 257 miles of railway had been laid down, and 117 nearly completed, and there was a network of telegraphic wires all over the inhabited portions of the colony. No aid was afforded by the state to religion; and of the population, about one-half belonged to the Church of Eng-

land, and one-fourth to the Church of Rome. He believed that Tasmania had not progressed more rapidly because she had hitherto suffered from contiguity to, and comparison with, the neighboring colonies, which offered a wider field and greater scope for the energy and enterprise of the settler. As this field, however, gradually became occupied, Tasmania's progress would again become assured. He thought, however, that a colony which had increased her revenue during the last decade from £340,000 to £550,000, and her exports from £1,000,000 to £1,400,000, was not to be deemed wanting in progress.

— Mrs. J. Lawrence Smith has presented to Harvard college a tablet in memory of her husband. The tablet is of bronze inlaid with silver, and is to be placed with the Smith collection of meteorites purchased by Harvard college after Dr. Smith's death. In the centre of the tablet there is an enamel portrait of Professor Smith, and this is surrounded by the different medals and decorations with which he was honored. It will be remembered that the collection of meteorites was sold for ten thousand dollars, of which sum Mrs. Smith contributed two thousand. With the eight thousand dollars actually received, Mrs. Smith has generously endowed the Smith medal, which is at the disposal of the National academy of sciences.

— The engraving of the various index-catalogue charts for the U. S. coast and geodetic survey has been commenced; the chart of the whole Atlantic coast and Gulf will be out by the middle of August; that for the Pacific coast will be issued Jan. 1. The Pacific coast tide-predictions for the year 1887 are now in the hands of the public printer; the predictions for the Atlantic coast will be sent to the printer this week; and the entire series will be ready for issue by the 1st of August.

— Plate No. 10 of the detailed topographical survey of the District of Columbia, made by Assistant John W. Donn of the U. S. coast survey, under the direction of the engineer commissioners of the district, has been printed and sent to the commissioners. The drawing of plate No. 16 is complete, and will be placed in the hands of the photolithographer this week. This sheet will show the location of the estate recently purchased by President Cleveland for a summer residence. For the want of sufficient funds, it has only been practicable to keep one topographical party at work on this important survey. Those having charge of the direction and execution of this work are urging congress to appropriate sufficient money to employ at least one more party and two skilled draughtsmen, in order to complete it.

— Bulletin No. 15 of the Ohio agricultural experiment-station contains an interesting account of further experiments by Prof. H. A. Weber upon the microscopic methods of distinguishing butter from other fats proposed by Dr. Thomas Taylor, and which were mentioned in a recent number of *Science*. It will be remembered that Dr. Taylor's first claim was that butter, cooled slowly under certain conditions, formed 'globules,' which, when viewed by polarized light, showed a well-defined St. Andrew's cross. Professor Weber having shown that this appearance was not characteristic of genuine butter, but might be produced in any common fat by treatment similar to that applied to the butter, Dr. Taylor then practically abandoned his claims for this test, and called particular attention to another test as being most important and characteristic. According to Dr. Taylor, if a sample of butter is viewed by polarized light, a plain selenite being placed between polarizer and analyzer, a uniform color is observed: if any solid fat, like lard or tallow, be thus viewed, the fat will exhibit prismatic colors. It is this test which has been the subject of Professor Weber's investigations, and he finds it as fallacious as the former one. Any of the fats under consideration, if melted, and cooled slowly, and then submitted to Dr. Taylor's test, will show the prismatic colors, due to the action of the comparatively large crystals formed upon the polarized light. On the other hand, the same fats, if cooled quickly, so as to prevent the formation of large crystals, present the uniform tint claimed by Dr. Taylor as characteristic of butter-fat. An interesting observation was made upon a sample of butter which had been kept in a closed tin box in the laboratory, and had become alternately hard and soft with the changes of temperature, but never melted. This butter, which had hardly been exposed to greater changes of temperature than much country butter is liable to, showed the prismatic colors claimed by Dr. Taylor as characteristic of foreign fats. Professor Weber concludes this account of his experiments in the following words: "Taking the whole of Dr. Taylor's microscopical investigations into account, it may be said that they have received more attention at the hands of American investigators than their crude methods and erroneous conclusions would warrant."

— The distinguished mechanical engineer, Adolphe Hirn, has been decorated with the Order of the rose by the emperor of Brazil.

— Assistant C. H. Boyd of the coast survey has been instructed to make an examination into the changes in the shore line in the vicinity of Monomoy, Mass.; instructions have been issued to Sub-

assistant W. C. Hodgkins to make an examination of the point at Cape Lookout where great changes have been reported since the last examination; Lieutenant-Commander Brownson, U.S.N., chief hydrographic inspector, is now in New York, inspecting the Gedney, Bache, and Endeavor; Lieut. F. S. Carter has been detached from the coast-survey steamer Gedney, and placed in charge of the vessels laid up at the New York navy-yard; reports from the steamers Paterson and McArthur, which are stationed at Wrangle, Alaska, state that the weather is very favorable for work, and the results thus far attained have been most gratifying.

— The Royal academy of sciences at Turin has announced the grand Bressa prize of twenty-four hundred dollars, to be awarded at the close of 1889 for the most meritorious work or discovery in the physical or natural sciences, produced during the years 1886–89. The prize is open to the world.

— The International literary and artistic association, says the *Academy*, will not hold its next congress at Stockholm this year, as had been arranged, but at Geneva, on the 18th of September. The subjects to be discussed will comprise the right of property in *lettres missives*, the agreements as to publication and the relations between authors and publishers, the right of property in the titles of literary and scientific productions, and the assimilation of the right of translation with that of production.

— Naturalists will recall that some fossil egg-masses of insects of extraordinary size were found a few years ago in Colorado in beds referred to the Laramie period, and considered by Scudder as indicating the existence of a neuropterous insect very closely allied to our great 'Hellgramite,' Corydalus cornutus. It now appears that precisely similar bodies, at first supposed to be of vegetable origin, have been found in the lignites of Trets, near Aix, France, associated with Nelumbium in beds universally referred to the lower Garumnian, or, even lower, to the Campanian; that is, to the horizon of the upper cretaceous. The Garumnian has already been compared to our Laramie group.

— The Würtemberg ministry has invited the governments of Bavaria, Austria, Baden, and Switzerland to participate in an examination and surveys of the deeper portions of the Lake of Constance, to serve in the preparation of an accurate map of the lake's bottom. A commission of specialists will meet in Friedrichshaven to decide upon the methods and extent of the proposed undertaking.

— Prof. G. Dewalque of Liége, the secretary of the Commission of the International congress of geologists on the map of Europe, desires to sell his large library *en bloc*, and wishes to know whether some individual or institution will not make him an offer for it on the basis of a catalogue of its contents.

— The output of shad hatched by the U. S. fish commission up to the present time has been 12,000,000. These have been sent away, as fast as hatched, to various streams, and deposited: 356,000 have gone to the Cheat River at Grafton; 370,000 to the Chattahoochee, Georgia; 626,000 to the Chickahominy; 329,000 to the Dan; 758,000 to the Mattapony; 385,000 to the Pamunky; 1,110,000 to the Occoquan; 757,000 to the Shenandoah; 380,000 to the James; 379,000 to the Appomattox; 603,000 to the Monocacy; 609,000 to the Patuxent; 1,234,000 to the Rivanna; 390,000 to the Accokeek Creek; 389,000 to Aquia Creek; 1,270,000 to the Rapidan; 391,000 to the North Anna; 1,070,000 to the Rappahannock; 1,282,000 to the Little Falls of the Potomac; 1,586,000 to the Hudson; and 1,000,000 to the Colorado. All of these fish are not, of course, counted and numbered. They are measured in the jars. It is known by actual count how many eggs are necessary to fill a jar to the depth of an inch. A quart, it is estimated, will hold 28,000 eggs.

— New discoveries of petroleum in southern California are causing much excitement, says the Los Angeles *Herald*. A well recently bored in Ventura county is yielding fifty barrels of oil daily.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Some devices for teaching historical geography.

A FRIEND having called my attention to some suggestions, in *Science* of April 9, on maps suitable for history classes, it has occurred to me that perhaps the results of several years' experimenting with different devices for teaching historic geography might be of interest to some of your readers.

That helps are needed to illustrate the intricate territorial changes of continental history, scarcely requires to be further emphasized. Much of history, indeed, is little more than the record of such changes. The contrast between the hopeless confusion of many important epochs when studied without historical maps, and the beautiful clearness of the same epochs with the maps, is simply astounding, and is the true warrant for the time honored claim of geography as one of the two eyes of history.

Having become impressed, after a deal of unsatisfactory teaching, that better machinery than the ordinary is almost a necessity, I have spent considerable time and pains trying different devices. For several years I used a map of Europe permanently

painted on the blackboard, and, to show territorial changes, filled in with colored crayons. This method has the great advantage of growing before the class, changing with the history. But it is wanting in cleanness and accuracy, requires much disagreeable labor, and involves destroying the boundaries of the one period before putting on those of the next; so that the eye cannot compare the two stages.

Accompanying this device, I have used that for the pupils which you suggest; i.e., small uncolored outline-maps, to be filled in for successive epochs by the student himself. My class in medieval history last year was required to make eighteen of these. To get the outline-maps, we have copies made by the hektograph process. Tracing-paper can be used to get the first copy, thus bringing this scheme within the reach of every teacher.

We also use your scheme involving a series of wall-maps for successive epochs. With other teachers I have often felt the need of cheap printed outline-maps, to be filled up in the course of the work. In lieu of such outline-maps, we have gotten along pretty well by the use of white holland, which is sufficiently translucent to be used like tracing cloth; so that the labor of carefully drawing the map has to be performed but once. This material we buy in quantities, so that it costs but twelve cents and a half per yard. To secure the requisite width, two or more pieces can be sewed together. Being strong to resist wear and tear, for maps it is about the most satisfactory material with which I am acquainted.

But the best device, by all odds, which we have yet hit upon, is a system of ground-maps with superposable fractional maps. The original map we mount on a soft pine back, and indicate every change by overlaying it with fractional maps corresponding in natural features to the original, but colored in such manner as to show the altered political relations. Thus, having a map of Italy divided and colored to show its political condition before 1859, — with Sardinia and Piedmont red, Austrian territory yellow, Parma orange, Modena gray, Papal States brown, Tuscany olive, and Naples purple, — we tell the story of Magenta and Solferina; then lay over yellow Lombardy a red Lombardy, to show its acquisition by Sardinia; and a green Savoy and Nice over the red Savoy and Nice, to show how France exacted them as the price of her assistance. Then, on Victor Emanuel's acceptance of the offered sovereignty of Parma, Modena, Bologna, and Tuscany, a red patch is tacked over these districts. So a red Sicily and a red Naples are laid on when Garibaldi's work is done. A red Ancona and Umbria finish the work for 1860. In 1866 Venetia is covered with red; and in 1870, the remainder of papal territory.

During the year we have worked out sets for the territorial history of France from 1550 to 1870, of Prussia from 1400 to 1866, of the Ottoman empire from 1680 to 1886, of western Europe from 395 to 888, etc. From no other plan have we obtained results at all comparable with those of this year.

The advantages of this device are apparent. It is superior to the series of maps, because, 1°, it changes with history; 2°, a more definite concept of the changed territory is obtained when it can be taken off and handled as a piece of cloth; 3°, the student can be set to work out the changes for himself, — to build up or take to pieces the map; and, 4°, it is less expensive, involving but one or two full-sized maps. It is superior to the blackboard scheme, because, 1°, it is clearer; 2°, it is more accurate; 3°, it is easier to reproduce, and so not too difficult for the student and the overworked teacher; and, 4°, it preserves both the original condition of things and the changed order, each of which can be reproduced in turn, and thus the exact nature and extent of the change can be clearly and definitely seen.

Incidentally, the use of a soft-wood back has suggested several little devices which we find quite helpful. For battles we use a bright red spear-head of stiff cloth fastened with sealing-wax to the head of a needle. These, being removable, are placed on the map just where events call for them; can be made large enough to show across any room without permanently disfiguring the map; do not crowd regions like the Netherlands, where many battles have been fought, till the confusion is hopeless; and, finally, furnish, in putting them on, a useful exercise for the student. Similarly, we use a yellow star on a black circle for treaties of peace, and lines of colored braid to follow expeditions, such as Alexander's or the crusades. Doubtless other expedients of the same nature will suggest themselves.

F. M. TAYLOR.

Albion, Mich., May 28.

Some Ojibwa and Dakota practices.

Science (vol. iii. No. 57) records on p. 298 the discovery of human bones suggesting cannibalism in a cave near the village of Holzon Brunswick, reported to the Berlin anthropological society by Professor Nehring. "It is the first evidence discovered," says the author, "that a race of anthropophagi ever existed in Germany. The bones were not fully calcined, and had evidently been chopped to obtain the marrow. As a still greater proof of cannibalism, it was shown that the bones were thrown in a heap, as if cleared after a meal. . . . In the subsequent discussion Professor Virchow raised some objections to the cannibal theory."

A case like the one in question might sometimes, probably, be referable to exceptional cannibalism; that is, to an act of cannibalism committed under extraordinary conditions, by a race not commonly addicted to the vice, and even in general, perhaps, abhorring it. In solving problems of this sort, it becomes a pertinent inquiry, how savage man of the historic period actually 'takes his meals,' if such they may be called, and whether or not he practises disposing of the residuum of his food in the orderly manner indicated above.

An instance of man-eating, with its attendant circumstances, occurring among the wild Ojibwas of Lake Pokegema, Minnesota, is cited below. It is put on record in this place for the purpose of illustrating exceptional cannibalism in non-cannibal tribes, and of showing how, half a century ago, Algonkins and Dakotas still inhabiting the northwest were accustomed to hew in pieces, distribute, and leave to be gnawed by animals, the slaughtered bodies of their enemies. The given facts, furthermore, emphasize the possible co-existence, in the same aboriginal community, of two widely differing grades of civilization, particularly in the case of savages just emerging from barbarism in virtue of their association with enlightened races.

It should be stated that this paper has been prepared from verbal and written material kindly

furnished the writer by Mrs. Elizabeth Taylor Ayer, a missionary lady who was a keenly interested participant in most of the events reported. Among the early writers of Minnesota, fragments of the same narrative occur, presenting, however, different phases of this history, and altogether lacking the element of continuity.

The Ojibwa band of aborigines settled about Lake Pokegema, in what is now Pine county, Minn., included in 1841 two Ojibwa braves, — one named We-*zhai*-ma; the other called by the missionaries stationed at that point Julius Caesar, both on account of his distinguished bearing, and his prowess in battle.

Some time in May, 1841, these two Indians were despatched down the St. Croix valley to St. Croix Falls for needful supplies. Upon reaching their destination, they learned that their hereditary enemies, the Sioux or Dakotas, were about to attack the Pokegema Ojibwas, when, leaving their supplies behind them, they hastened homeward to give warning of the impending danger.

During the return journey, they encountered the war-party in question, under circumstances which rendered advance and retreat alike dangerous. Without a moment's hesitation, the young Ojibwas fired upon the hostile party, Julius Caesar killing one of the leaders of the expedition: the two then parted from each other, and, in accordance with Indian tactics, fled in opposite directions.

The foe pressed hotly upon Julius. He threw his gun lightly over one shoulder, and, with a backward half-aim, shot dead a second Sioux warrior, who proved to be a brother of the first. These two Sioux braves were sons of Little Crow, senior, a prominent and influential chief of the Kapota band of Dakotas, at that time settled within a few miles of the present site of the city of St. Paul.

Julius himself immediately fell. His body was dismembered. His limbs were literally hewed in pieces and scattered to the four winds. His head was scalped, detached from the trunk, placed in a kettle with fragments of his person, adjusted with the face turned toward the bodies of his victims seated near, and left dangling from the bough of a convenient tree. A friendly party eventually discovered and identified the mutilated remains, and conveyed intelligence of the disaster to the families of the young men at Lake Pokegema. No traces of We-*zhai*-ma's body could be found, but, as he had completely disappeared, it was believed that he likewise had perished at the hand of the enemy.

The Pokegema Indians apprehended further hostilities in the immediate future. The better to guard against surprise, such of them as were dwelling upon the mainland abandoned their places, and took refuge with friends upon a small island near the centre of the lake. The sole approach to this spot being by water, the Pokegemas withdrew their canoes at night from the outer shore, and secured them against capture upon the island. The women had at the proper season planted potatoes, maize, and other vegetables upon the mainland in large open fields which they called gardens. These they cultivated during the day, returning to their island lodges by boat at nightfall.

Three runners were soon despatched from Lake Pokegema to acquaint friends at Mille Lacs with the fate and supposed fate of Julius and We-*zhai*-ma. Early upon the morning chosen for their departure, they were set across the lake to the west, in canoes, by two young girls of the band, who accompanied them for the purpose of returning the boats used to their owners at the island. A hostile force of Sioux warriors had meanwhile succeeded in penetrating secretly to Pokegema, and these were now ambushed in two bodies upon the eastern and the western edges of the lake. The larger division, of one hundred fighting men, was posted upon the eastern shore, in the rear of the gardens, and was expected to make the main attack upon the Ojibwas. The western party, of thirty, comprising men and some women and boys, was so stationed as to prevent the Ojibwas from retreating across the lake during battle. The latter force had been strictly charged to make no sign until firing should be heard from the eastern shore.

One or two of the Sioux hotheads, however, could not withstand the temptation to fire upon the canoes as they reached the beach. The Ojibwa runners promptly returned the fire, and made for the shore. They finally escaped their opponents by plunging into the forest, though all were more or less wounded.

The two Indian maidens were small creatures of only about twelve years, being pupils at the mission-school. These girls sprang out of the canoes, and in their terror waded from the shore into the shallow waters of the lake. They were pursued and captured by the Sioux party. The men, dragging them to land, butchered them upon the spot, their dying shrieks ringing in the ears of the distracted parents at the island. They were scalped, their heads were cut off, a hatchet was sunk in the brain of each, their bodies were mutilated, and the heads were set up in mockery in the sands of the shore.

In brief, the Sioux party lost two men killed outright, and one mortally wounded. So assured of success in this expedition were they, that they had brought with them a certain number of boys and women to aid in carrying away their anticipated spoils. In finally quitting the field, they possessed themselves of a boat owned by the missionaries, and, depositing their slain within it, moved two or three miles up Snake River, where they landed. Here they arrayed the dead in the best they could procure, and left them seated in an upright position against the trunks of trees.

Two days after the fight, certain of the wild Pokegemas ascended the river in search of the dead bodies of the enemy, which they found arranged as described, and which they proceeded to hew in pieces, and convey to the island for distribution among the members of their band. All those who had lost a relative at the hand of a Sioux were to be supplied with a portion of a Sioux body, those recently bereaved being the first to be served.

The mother of one of the slaughtered girls was a pagan. She received as her allotment the head of a Sioux warrior. The mother and the wife of Julius, who were no longer wild Indians, had appropriated to them an arm each. The savage mother, frantic with grief and rage, repeatedly dashed the head vengefully among the stones, and tossed and spurned it with her foot along the sands until weary, eventually leaving it to be eaten by the dogs, and to moulder away among the refuse of the village. On the other hand, the mother and wife of Julius accepted in silence the customary mementos of victory, and withdrew with them to their lodge. Here the two bereaved women took the dissevered limbs upon their

laps, swathed them carefully in wrappings of cloth selected by the mother from her most valued treasures, repeated above them a short prayer, and, stealing out unobserved, dug a suitable pit and buried them in it.

The night after the return of the Pokegemas with the Sioux bodies, they treated themselves to a great feast at the island, which culminated in the usual hideous orgies. From this banquet the better class of the band absented themselves. Sioux flesh was at this time boiled and eaten with wild rice. Mrs. Ayer, testifying absolutely to this latter point, adds, that the given instance of cannibalism is the only one coming to her personal knowledge during the whole period of her connection with the wild Ojibwas, something more than twenty years.

We-*zhai*-ma, who had been mourned as a victim of the Sioux, re-appeared after the attack on Lake Pokegema. He had managed to elude pursuit while the enemy were busied with their captive, and had finally succeeded in effecting escape. When he eventually resumed his return, it was by a circuitous route which materially delayed his arrival at home.

The events here detailed sealed the fate of the Pokegemas as an independent band. Constant dread of Sioux incursions caused these people to abandon their hunting and fishing grounds at the lake, and betake themselves to regions less accessible to the foe. They melted away from Pokegema as if by magic, withdrawing singly and in groups, and retiring for the most part to the north and north-west; many of them fleeing to Mille Lacs and Lake Superior. Within a very short time they were wholly absorbed in cognate branches of the great Ojibwa tribe, presenting a case of the complete disintegration of an aboriginal community without corresponding loss.

FRANC E. BABBITT.

Coldwater, Mich., June 4.

The agricultural experiment-station of New Jersey.

For a state so peculiarly located with reference to market facilities as New Jersey, and containing, withal, such large areas of unproductive soil, it would seem most appropriate that the study of artificial sources of soil-fertility should constitute, as it does in that state, the primary work of the state agricultural experiment-station.

There are certain features of the work of this New Jersey station, as detailed in its recent reports, to which I wish briefly to direct attention. One of these is, that, with but trifling exceptions, the entire resources of the station are directed to the solution of the chosen problem, and that no attempt is made to skim over the limitless field of agricultural research.

Another notable feature is that the field and feeding experiments, all of which bear directly or indirectly upon the central problem under investigation, are conducted upon the parallel lines of laboratory analysis accompanied by field or stable tests; the fact having apparently been recognized that the chemist's analysis alone is not a sufficient criterion upon which to base an estimate of the agricultural value of a fertilizer or feeding-stuff, although an essential factor in forming that estimate.

A third conspicuous feature of the work of this station is the absence of that class of experiments which can justly be styled 'empirical.' The field-experiments especially are co-ordinated upon a thoroughly scientific plan, and constitute a form of research which requires for its successful prosecution as high a degree of scientific ability as is ever called for in the chemist's or physiologist's laboratory.

The institution of duplicate experiments on farms in various parts of the state is another commendable feature of this station's work, in that it not only brings under observation the effects of differences in soil and climate, but is educating a number of farmers in the methods of accurate experimentation.

No doubt there are many citizens of New Jersey who feel that their special interests are being neglected by the state experiment-station; but I believe that the station is doing wisely in confining its work to such questions of primary importance as may be thoroughly handled. To do a definite work well is far better than to skim over a larger field, especially in science, where half-truths are so liable to be whole errors; and I believe that its present course will the sooner bring to this station the means for enlarging its field of useful work.

C. E. THORNE.

Penetrating-power of arrows.

Some time since, I noticed a letter in *Science* asking for information in regard to the penetrating-force of the arrow.

I have in my possession the sixth dorsal vertebra of a buffalo, the spine of which contains an iron arrow-point. The arrow struck the spine about two inches above the centre of the spinal canal, and penetrated the bone .82 of an inch. The bone at the point struck is .55 of an inch thick, and the point of the arrow protrudes beyond the bone .27 of an inch. The arrow was shot from the right side of the animal, and the plane of the point was horizontal. The animal was mature, and the bones well ossified. Though the vertebra has been much weathered, the epiphyses adhere closely. The animal was not as large as some individuals. The whole vertical length of the vertebra is thirteen inches.

The arrow must have penetrated several inches of flesh before striking the bone. OLIVER MARCY.

North-western university,
Evanston, Ill., May 31.

Spectrum of comet c. 1886.

Comet c. 1886 presents to telescopic vision a rather bright oval of light, with an ill-defined nucleus in the north preceding quadrant. Although a faint object, it was so temptingly situated for observation, that, rather out of curiosity, the telescope, already employed in faint spectroscopic work, was directed upon it. The method of observation, while adapted to use very faint light, is yet supplied with checks against optical illusion. Observations were obtained on May 26, 28, and June 4. They afford five loci of light, agreeing fairly in position with the five series of lines in the low-temperature spectrum of carbo-hydrogen, and afford a strong suspicion of other loci, two of which lie near strong lines in the low-temperature spectrum of oxygen, and others to the low-temperature spectrum of carbo-oxygen. The spectra given in micrometric gaseous spectra by Piazzi Smyth have in each case been used as reference.

O. T. S.

New Haven, Conn., June 8.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 11, 1886.

ETHICS AND ECONOMICS.

In the study of no science is it more important to bear in mind the distinction between words and ideas than in political economy. Locke enforces the far-reaching character of this distinction in general in one of the books of his wonderful work, 'Essay on the human understanding.'

The following personal anecdote is narrated; and so weighty is the truth which it conveys, that it ought to be read frequently, and fully grasped: "I was once in a meeting of very learned and ingenious physicians, where by chance there arose a question whether any liquor passed through the filaments of the nerves. I (who had been used to suspect that the greatest part of disputes were more about the signification of words, than a real difference in the conception of things) desired, that, before they went any further on in this dispute, they would first establish amongst them what the word 'liquor' signified. . . . They were pleased to comply with my motion, and, upon examination, found that the signification of that word was not so settled and certain as they had all imagined, but that each of them made it a sign of a different complex idea. This made them perceive that the main of their dispute was about the signification of that term, and that they differed very little in their opinion concerning some fluid and subtile matter passing through the conduits of the nerves, though it was not so easy to agree whether it was to be called 'liquor' or no, — a thing which then each considered he thought it not worth the contending about."

This illustration brings us at once to the heart of a large part of past economic controversies. The same words have stood to different men for different ideas; and in their hot debates about capital, value, money, and the like, they have often been talking about things not at all the same, though they supposed them to be so. One man comes forward with a definition of value, and cries out, 'It is of vital importance,' as if that would settle all the social problems of the ages, whereas he has simply told us how he intends to use a particular word. He has really accomplished nothing in economics. Having settled upon his signs, he is ready to begin work. I may choose to adopt another definition: what does that signify? Simply this: to me this sign stands for this idea; both may be right, though it is of course important to be consistent, and retain throughout, the same sign for the same idea. Another gives a definition for capital, and then says, "To speak of productive capital is mere tautology." — "Of course, my dear sir," I reply, "the idea of productivity is implied in your definition, but it is not implied in mine. Your proposition, as often happens, is a mere repetition of what you already said about capital in your definition; but capital is not a living definite thing, like a horse or a cow. If it were, our difference of definition might imply error; at any rate, a difference of opinion."

Let us take the case of money. One economist ardently maintains that national bank-notes are money; another denies this. Controversy waxes warm; but ask them both to define money, and you shall find that each included his proposition in his definition. It is mere logomachy, nothing more.

One writer — and a very clever one — says 'value never means utility.' That is absolutely false. Good writers have used it with that meaning. What he ought to have said is, 'according to my definition it can never mean utility.'

When we pass over to definitions of political economy, we encounter like divergence of conception, and this explains much controversial writing. The words 'political economy' do not convey the same meaning to all persons, nor have they been a sign for an idea which has remained constant in time.

A definition means one of two things, — what is, or what one wishes something to be. What is political economy? We can give an answer which will describe the various classes of subjects treated under that designation, or we may simply state what we think the term ought to include. The latter course is that which the *doctrinaire* always follows.

Professor Sidgwick, in his 'Scope and method of economic science,' complains because certain recent writers include 'what ought to be' in their economic discussion. Does political economy include any thing more than what is? Is its province confined to an analysis of existing institutions and the social phenomena of to-day? Here we have to do with a question of fact. What do writers of recognized standing discuss under the

heading or title 'political economy'? Open your Mill, your Schönberg, your Wagner, your economic magazines, and you readily discern that the course of economic thought is largely, perhaps mainly, directed to what ought to be. It is not, as Professor Sidgwick says, that German economists, in their declamations against egoism, confound what is, with what ought to be; for no economists know so well what is, but that they propose to help to bring about what ought to be. This is the reason why the more recent economic thinkers may be grouped together as the 'ethical school.' They consciously adopt an ethical ideal, and endeavor to point out the manner in which it may be attained, and even encourage people to strive for it.

This establishes a relation between ethics and economics which has not always existed, because the scope of the science has been, as a matter of fact, enlarged. The question is asked, what is the purpose of our economic life? and this at once introduces ethical considerations into political economy. Of course, it is easily possible to enter into a controversy as to the wisdom of this change of conception. Some will maintain that economic science will do well to abide by the conception current at an earlier period in its development, and restrict itself to a discussion of things as they are. The discussion between representatives of these two conceptions would reveal differences of opinion as regards economic facts and economic forces.

Why should economic science concern itself with what ought to be? The answer must include a reference to the nature of our economic life.

This life, as it is understood by representatives of the new school, is not something stationary: it is a growth. What is, is not what has been, nor is it what will be. Movement is uninterrupted; but it is so vast, and we are so much a part of it, that we cannot easily perceive it. It is in some respects like the movement of the earth, which can only be discerned by difficult processes. We are not conscious of it. Although the thought of evolution of economic life had not until recently, I think, been grasped in its full import, yet economists of the so-called older school, like Bagehot and John Stuart Mill, admitted that the doctrines which they received applied only to a comparatively few inhabitants of the earth's surface, and even to them only during a comparatively recent period. In other words, English political economy described the economic life of commercial England in the nineteenth century. Now, a growth cannot well be comprehended by an examination of the organism at one period. The physiologist must know something about the body of the child, of the youth, of the full-grown man, and of the aged man, before he fully understands the nature of the human body. Our biologists, indeed, insist that they must go back to the earliest periods, and trace the development of life-forms forward during all past periods, and they endeavor to point out a line of growth. The modern economist desires to study society in the same manner. Lord Sherbrooke and others have claimed for political economy the power of prediction, and this has been based on the assumption that men will continue to act precisely as they have acted in time past. What seems to me a more truly scientific conception is this: the economist hopes to understand industrial society so thoroughly, that he may be able to indicate the general lines of future development. It follows from all this, that the future is something which proceeds from the present, and depends largely upon forces at work in the past.

More than this is true. The economic life of man is to some considerable extent the product of the human will. John Stuart Mill draws the line in this way: he says that production depends upon natural laws, while distribution 'is a matter of human institution solely.' Both statements are somewhat exaggerated. The truth is, political economy occupies a position midway between physicial or natural science and mental science. It is a combination of both. With the inventions and discoveries of modern times, we seem almost to have solved the problem of production; but the problem of an ideal distribution of products still awaits a satisfactory solution. But how largely does this depend on human will? Mill points to the institution of private property as fundamental in the distribution of goods. This is true, and the historical economist discovers that the idea of property is something fluctuating. He ascertains that there was a time when landed property was mostly held in common; that in certain parts of the earth it is still held in that manner; while there are far-reaching variations in systems of land-tenure, even in England, France, and Germany, — all of them, countries in about the same stage of economic development. Take changes in labor. The laborer has been a slave, a serf, and a freeman in various stages of economic development. His condition has been one of human institution, yet how largely fraught with consequences for the distribution of goods. One more illustration: take even railways. How differently would the wealth of the United States to-day be distributed, had we adopted an exclusive system of state railways in the beginning of railway constructions, and adhered to that system!

The ethical school of economists aims, then, to direct in a certain definite manner, so far as may be, this economic, social growth of mankind. Economists who adhere to this school wish to ascertain the laws of progress, and to show men how to make use of them.

It has been said that recent tendencies in political economy indicate a return to Adam Smith; and as in philosophy the watchword, 'Back to Kant,' has come into vogue, it has been thought that political economists ought to find inspiration in the cry, 'Back to Adam Smith!' While recognizing the truth which this implies, I am inclined to the opinion that in some respects the drift is back even to Plato. If you should attempt to develop a conception of political economy out of Plato's writings, would it not, when formulated, be about as follows: Political economy is the science which prescribes rules and regulations for such a production, distribution, and consumption of wealth as to render the citizens good and happy?[1] With this compare Laveleye's definition as found in his text-book: "Political economy may therefore be defined as the science which determines what laws men out to adopt in order that they may, with the least possible exertion, procure the greatest abundance of things useful for the satisfaction of their wants; may distribute them justly, and consume them rationally."[2] Though exception may be taken to this definition as a rather too narrow conception of political economy, it answers very well the purposes of the present article, for it draws attention to the ethical side of the recent development of economics.

It is well to describe somewhat more in detail the ethical ideal which animates the new political economy. It is the most perfect development of all human faculties in each individual, which can be attained. There are powers in every human being capable of cultivation; and each person, it may be said, accomplishes his end when these powers have attained the largest growth which is possible to them. This means any thing rather than equality. It means the richest diversity for differentiation accompanies development. It is simply the Christian doctrine of talents committed to men, all to be improved, whether the individual gift be one talent, two, five, or ten talents. The categorical imperative of duty enforces upon each rational being perfection 'after his kind.' Now, the economic life is the basis of this growth of all higher faculties, — faculties of love, of knowledge, of aesthetic perception, and the like, as exhibited in religion, art, language, literature, science, social and political life. What the political economist desires, then, is such a production and such a distribution of economic goods as must in the highest practicable degree subserve the end and purpose of human existence for all members of society.

This is different from the conception of life which is current in society, though it is in harmony with the ethical ideal of Christianity. The majority of the well-to-do tacitly assume that the masses are created to minister unto their pleasure, while this ethical ideal does not allow us to accept the notion that any one lives merely 'to subserve another's gain.' An illustration will make clear this difference. Listen to two ladies discussing the education of the serving-class, and you shall find that the arguments probably all turn upon the effect thereby produced upon them as servants.

As has already been stated, the demand of ethics is not equality. A large quantity of economic goods is required to furnish a satisfactory basis for the life of the naturally gifted. Books, travels, the enjoyment of works of art, a costly education, are a few of these things. Others lower in the scale of development will need few economic goods. One may be able to satisfy all rational needs for what can be purchased for three dollars a day, while another may need four times that amount. Again: while it is probable that those who belong to the ethical school, as it is called, with Mill, look forward with satisfaction to a time when the condition of an ordinary servant will be held to be beneath members of civilized society, it is doubtless true that large numbers to-day, like, perhaps, the majority of our negroes, will find in the condition of servants in really superior families precisely the best possible opportunity for personal development which they are able to use.

The ethical view of economics rejects the communism of Baboeuf as something not merely impracticable, but as something not at all desirable. On the other hand, social ethics will not allow us for one moment to accept the apparent ideal of Renan, when he calmly assures us, that, to such an extent do the many subserve the gain of the few, that forty millions may well be regarded as dung, do they but supply the fertility which will produce one truly great man. Like many others, including indeed representatives of high culture, he seems to regard human development as something existing altogether apart from individuals, as an end to be pursued in itself without regard to the condition of human beings as such.

It cannot well be argued that present society satisfies, in so high a degree as one may rationally desire, the demands of ethics. On the one hand,

[1] See the writer's 'Past and present of political economy,' p. 48.

[2] Taussig edition, New York, 1884, p. 3.

we see those who are injured by a superfluity of economic goods; and, on the other, those who have not the material basis on which to build the best possible superstructure. In both cases this is waste of human power, or, we might say, waste of man.

It is desired in future so to guide and direct the forces which control the production and distribution of economic goods, that they may in the highest degree subserve the ends of humanity. It is not claimed that the power of man is unlimited, but it is maintained that it can and will accomplish great things.

Here we have at once a standard by which to test economic methods. Take the case of low wages. It is argued that low wages increase possible production. Even if this be so, such wages diminish the power of the recipients to participate in the advantages of existing civilization, and consequently defeat the end and purpose of all production. Child labor, female labor, and excessive hours of labor, fall under the same condemnation. In the language of Roscher, "the starting-point as well as the object-point of our science is man."

It has been said truthfully that the essential characteristic of the new political economy is the relation it endeavors to establish between ethics and economic life. A new conception of social ethics is introduced into economics, and the stand-point is taken that there should be no divergence between the two. While representatives of an older view endeavor carefully to separate the two, the adherents of the ethical school attempt to bring them into the closest relation,— indeed, I may say, an inseparable relation. They apply ethical principles to economic facts and economic institutions, and test their value by that standard. Political economy is thus brought into harmony with the great religious, political, and social movements which characterize this age; for the essence of them all is the belief that there ought to be no contradiction between our actual economic life and the postulates of ethics and a determination that there shall be an abolition of such things as will not stand the tests of this rule. If industrial society as it exists at present does not answer this requirement, then industrial society stands condemned; or, in so far as it fails to meet this requirement, in so far is it condemned. It is not that it is hoped to reach a perfect ideal at one bound, but that the ideal is a goal for which men must strive. The new conception of the state is thus secondary, in the opinion of the adherents of the ethical school, to the new conception of social ethics. Doubtless there is a new conception of the state; for in this co-operative institution is discovered one of the means to be used to accomplish the end of human society, the ethical ideal. Perhaps still more important is the departure of economists from the individualistic philosophy which characterized the era of the French revolution, and which has gained such a stronghold in America, because our republic happened to be founded at a time when this view of individual sovereignty was in the ascendant. The philosophy of individualism came to us from England, which had been influenced by France, as well as directly from France, at a time when our thought was in a formative period, and was especially open to new ideas. But the ethical school, I think it safe to say, places society above the individual, because the whole is more than any of its parts. In time of war, society demands even the sacrifice of life: in time of peace, it is held right that individual sacrifices should be demanded for the good of others. The end and purpose of economic life are held to be the greatest good of the greatest number, or of society as a whole. This view is found distinctly expressed in Adam Smith's 'Wealth of nations,' particularly in one place, where he says, "Those exertions of the natural liberty of a few individuals, which may endanger the liberty of the whole society, are, and ought to be, restrained by the laws of all governments." This view, however, does not imply a conflict between the development of the individual and the development of society. Self-development for the sake of others is the aim of social ethics. Self and others, the individual and society, are thus united in one purpose.

It is not possible to develop all these thoughts in a single article, for that would indeed require a large book; nor can any attempt be made to offer any thing like complete proof of the various propositions enunciated. It has been my purpose to describe briefly a line of thought which it seems to me characterizes what is called the new political economy; and it should be distinctly understood that this paper claims only to be descriptive and suggestive.

It may be well, in conclusion, to point out the fact that the ethical conception of political economy harmonizes with recent tendencies in ethics. The older ethical systems may, I think, be called individual. The perfection of the individual, or the worthiness of the individual, to use another expression, was the end proposed. Moral excellence of a single person was considered as something which might exist by itself, and need not bear any relation to one's fellows. Men were treated as units, and not as members of a body. The new tendency of which I speak, however, proceeds from the assumption that society is an

organism, and that the individual is a part of a larger whole. Rudolph von Ihering develops this idea in the second volume of his 'Zweck im Recht.' The source of ethics he finds in society; the end of ethics likewise is discovered in society; and from society, according to this theory, is derived the ethical motive-power which resides in the human will.[1] Social ethics thus replaces individual ethics. Ethics becomes one of the social sciences, and indeed, to use Ihering's expression, the 'queen' of them all. With this view of Ihering, should be compared the teachings of Lotze; and I will close this paper with a quotation of some length from his 'Practical philosophy:' "To antiquity, man appeared without any manifest attachment to a coherent system, transcending his earthly life, pre-eminently as a creature of nature, whose aim — not so much moral as altogether natural — could only consist in bringing all the bodily and spiritual capacities with which he is endowed by nature, to the most intensive, and at the same time harmonious, cultivation. . . . This whole culture is not a preparation of the powers for a work to be accomplished; but it is a self-aim to such an extent that the self-enjoyment of one's own fair personality, and its secure tenure against all attacks from without, form the sole content of such a life. . . . Just the opposite of this, under the influence of Christianity, the conviction is formed, that, strictly speaking, every man is called only to the service of others; that the effort to concentrate all possible excellences in one's own person is, at bottom, only a 'shining vice;' but true morality consists in the complete surrender of one's own self, and in self-sacrifice for others. . . . Nothing, therefore, remains for us to do but to supplement the ancient self-satisfaction, without surrendering aesthetic culture, by having all the powers acquired by such culture placed at command for the accomplishment of a life-aim in accordance with motions of benevolence;" and "benevolence, . . . the service of others, constitutes the focal point of ethical ideas."[2] RICHARD T. ELY.

[A reply by Prof. Simon Newcomb, to this article, will appear in an early number.—ED.]

DR. HUGHLINGS-JACKSON ON EPILEPSY.

FOR many years Dr. Hughlings-Jackson of London has been advocating a theory of epilepsy highly important for its general bearings on physiology and psychology, and for its harmonizing with recent results obtained by experiments on animals An era in the study of cerebral physiology was made when Fritsch and Hitzig discovered that the cortex of the brains of dogs was directly excitable, and that the result of such excitation was a series of co-ordinated movements of definite parts of the body. Dr. Jackson carried this fact over into pathology, and interpreted an epileptic discharge as nothing else than a sudden, rapid, excessive, and discharging cortical lesion: to use his own forcible language, it is simply a brutish development of many of the patient's ordinary movements. "Speaking figuratively, we may say that the epileptic discharge is trying to develop all the functions of the body excessively, and all at once: a severe fit is a fairly successful attempt. Let me give a very simple illustration. If there be a centre for locomotion, then, during slight sequent discharges of its elements in health, there is walking or running; but if very many of those elements were to discharge suddenly, rapidly, and excessively, the man walking or running would not go faster: on the contrary, he would be stopped, would be stiffened up into a tetanus-like attitude by the *contemporaneous* development of many locomotive movements."

In a recent article (*Brain*, April, 1886), Dr. Jackson has further extended and in part modified his theory. His former position was that all discharging lesions issued from the cortex; i.e., the highest developed centres. He now admits that some such discharges have their central seat in less highly organized brain parts. That such is the case in animals was shown by such facts as that convulsions are possible in a rabbit through rapid bleeding, when the brain proper has been removed. This fact Dr. Jackson now carries over to human pathology in a very ingenious way. The fits involved by a discharging lesion of a lower centre, i.e., a medullary centre, would be apt to be connected with the respiratory apparatus which is represented in that region. Now, these 'inward fits,' or respiratory convulsions (laryngismus stridulus), occur mostly in children under one year of age, not often after two. This fact Dr. Jackson interprets as follows: at that period the highest cortical centres are not developed; of the activities developed in the infant at that time, these automatic vital functions are represented in what are then its highest functioning centres; and it is a discharging lesion from these that we see in a respiratory convulsion. The cause of the rapid and excessive discharge is shown to be a rapid increase in the venosity of the blood, which, when mild and gradual, serves as the normal stimulant of that

[1] See work, 'Zweck im recht.' A *résumé* of his arguments may be found in his article, "Die geschichtlich-gesellschaftlichen grundlagen der ethik," in *Jahrbuch für gesetzgebung, verwaltung, und volkswirthschaft*, für 1882.

[2] See Lotze's 'Practical philosophy,' Professor Ladd's edition, Boston, 1885, pp. 58-60.

respiratory centre. Furthermore, the spreading of the convulsions to the trunk and limbs finds its explanation in the fact that almost all the muscles of the body are at the call of the respiratory mechanism, when such additional strain is necessary in order to succeed in the fight for breath. And the whole series of facts finds a striking corroboration in the experiments of Saltmann, who found that the cortex of young puppies was unexcitable before a certain period, owing to the fact that these higher paths of motor effects had not yet been laid down. Dr. Jackson's view of epilepsy has met with considerable favor; and the modification of it now presented adds to this very suggestive, original, and ingenious interpretation of the facts of cerebral physiology and pathology. J. J.

ASTRONOMY IN APPLETON'S 'ANNUAL CYCLOPAEDIA.'

APPLETON'S 'Annual cyclopaedia' has for several years past included a summary of astronomical progress. These summaries have been so far from satisfactory as to call for some critical attention. They have been lacking in nearly every quality which they should have, — literary form, appropriateness, judicious selection, well-digested conclusions, and freedom from doubtful speculations. That for 1885, which has just been issued, does not show the slightest improvement, unless it is that the scissors are less freely used than formerly. In the qualities of redundancy and deficiency it seems, if possible, worse than its predecessors. As examples of the former, we have a whole column devoted to Dr. Huggins's supposed photographs of the solar corona, mixed up with his opinions of its nature and cause. A column is devoted to the red sunsets, which are not shown to have been more numerous than they always have been since the memory of man. Nearly the same space is devoted to pointless remarks upon eclipses in general and the two eclipses of the year. Not a word is said about the observations of these eclipses, — a deficiency which is perhaps compensated by the information that the next central eclipse visible in New Zealand will occur in 1927. The table of periodic comets has nothing to do with the astronomy of the year, and omits the only element of the slightest popular interest; namely, the times of perihelion passage. For the paragraph on occultations it is hard to imagine a *raison d'être*, unless it was to fill space. No allusion is made to any observations of an occultation during the year. More than a page is devoted to the system of telegraphing astronomical discoveries, which has been in operation for several years, and had, we think, been mentioned in previous volumes of the 'Cyclopaedia.' Any thing more valueless than the paragraph on bibliography it would be difficult to conceive. It concludes by informing us that "the *Sidereal messenger*, the only astronomical journal published on this continent, is issued monthly by Prof. W. W. Payne of Northfield, Minn." This journal so well deserves popular support, that we have no hesitation in repeating the announcement. The unsoundness and inconsistency of the remark on the solar spots are curious. We are first told that there has been no abatement, up to 1885, in their number or magnitude, and that suspicion therefore attaches to the theory of their periodicity. This is followed by several statements fixing the maximum in 1884 or 1885. As a matter of fact, Dr. Wolf fixed the maximum at the end of 1883.

Among subjects omitted may be mentioned, of American origin, Langley's 'Researches on lunar heat;' Hill's 'Contributions to the lunar theory;' Hall's 'Investigation of the satellites of Uranus and Neptune;' the discussion of the astronomical day, which has filled so prominent a place in scientific literature; and the work of Rowland and Pickering in celestial photography. The important foreign works which have been passed over, and which might have well taken the place of the stuffing that forms a third of the article, are too numerous to mention. The only conclusion which can be drawn is, that one-half of the article is better fitted to fill space than to give valuable information about the astronomical progress of the year.

BIMETALLISM IN THE UNITED STATES.

PROFESSOR LAUGHLIN has produced a most valuable book both for study and for reference. It is not only a history, but a critical examination of successive policies in the light of economic theory. It might, perhaps, be objected that the lesson is sometimes a little too obtrusive; but the independent reader who feels under no obligation to accept the author's conclusions may well pardon this fault. The author is a decided monometallist, and presents the arguments from the point of view of his own school. No objection can, however, be made to his statement of facts, and the reader can readily separate his arguments from them. One of the characteristic features of the book is the number, variety, and fulness of its graphic representations, which add greatly to the value of the work, and would have added yet more had they been better planned and arranged.

The history of bimetallism in the United States. By J. LAURENCE LAUGHLIN. New York, *Appleton*, 1886. 8°.

As an example of possible improvement, we may take the charts showing the fluctuations in the relative values of silver and gold. There are four such charts scattered in various parts of the book, without any apparent connecting-link.

The work is altogether so suggestive, that those who agree, as well as those who disagree, with the author's views, will find ample food for thought in reading it. The ground covered is so wide and the treatment so uniform, that it is scarcely possible to select one passage for comment rather than a score of others. It may be remarked, however, that the author's views of the ethical question involved in the monetary change of 1834 coincide more nearly with those of the advocates of free silver coinage at the present time, than we like to see. Up to 1834 our currency was on an almost pure silver basis, as the value of the gold in the gold dollar was a little greater than that of the silver in a silver dollar. In order to bring gold into circulation, it was necessary to change the ratio, which might be done either by increasing the weight of the silver dollar or diminishing that of the gold dollar. The latter course was adopted, on the ground, that, as silver was the standard at the time, the new coinage of gold should be accommodated to it. Professor Laughlin objects to this, that in reality the change in the marked ratio before 1834, which necessitated the new ratio, consisted in a depreciation of the value of silver; and that in consequence it was the silver dollar which should have been made heavier in order to bring it up to the old standard. This is the very argument on which the silver men now sustain their views. They claim that gold has appreciated in value, and that we should go back to the old silver dollar, the value of which they believe to have been more stable than that of the gold dollar. In either case, we think the sound view to be that the standard for the time being should be accepted rather than that of some past time.

GEOLOGY OF ARABIA AND PALESTINE.

IN 1883 the committee of the Palestine exploration fund wisely took advantage of an interruption of its regular work caused by the interference of the Turkish government to send Professor Hull, with a well-selected party, to explore some of the less-known districts of Arabia Petraea and southern Palestine, — regions of interest not merely geologically, but historically as well.

The route of the party extended through the Sinaitic peninsula, and thence into the Wady Arabah and to the southern end of the Dead Sea, then over the Judean hills to Gaza, and from this place to Joppa, Jerusalem, and the Jordan valley. The intention to explore farther north was frustrated by the snow of an unusually severe winter. The exploration was thus somewhat limited in its range; but Professor Hull has supplemented it by references to the works of the numerous geologists who have at various times studied the rocks of the districts traversed, and of the adjacent regions around the eastern end of the Mediterranean, which have many points in common.

Geologically considered, the district in question is part of an extensive region of western Asia and northern Africa, characterized by the wide distribution of cretaceous and eocene marine limestones resting on old and for the most part crystalline rocks, and in part overlaid and margined by very recent deposits.

The old gneisses and schists penetrated by great dikes and masses of intrusive granite and diorite, which constitute the mass of the Sinaitic Mountains, and extend thence along the Gulf of Akabah and the Wady Arabah, are similar in mineral characters to the Laurentian rocks of this continent; and Hull agrees with Oscar Fraas and the writer of this notice in referring them and similar rocks of upper Egypt to that ancient system. Thus we have the interesting fact that the nucleus of the old historic lands of Egypt and Arabia is composed of the same venerable rocks which occupy a similar place in northern Europe and in North America. Flanking these oldest rocks, there seem to be in Arabia, as in Egypt, newer slates and schists and igneous rocks, probably of Huronian or old Cambrian date.

Here, however, there occurs a great gap in the sequence, and we find nothing to represent the Siluro-Cambrian, Silurian, or Devonian systems; the next rocks in ascending order being sandstones, conglomerates, and limestones, the 'desert sandstone' of our author, which hold carboniferous fossils. These beds are not of great thickness or horizontal extent, but afford unequivocal evidence of their age in the fossils of the genera Zaphrentes, Productus, Orthis, etc., which they have afforded. A true lepidodendron has also been obtained from the sandstone.

Until recently these carboniferous rocks were confounded with an overlying sandstone of somewhat similar character, but of much greater thickness, — the Nubian sandstone, which is probably of lower cretaceous age, though it is by no means certain that it may not represent the Jurassic or even the trias. The relations of these sandstones, both in Arabia and Egypt, are somewhat perplex-

Physical geology and geography of Arabia Petraea, Palestine, and adjoining districts. By EDWARD HULL. Adelphi, *Com. Palestine explor. fund*, 1886. 4°.

ing, as they cannot be distinguished by mineral characters; and both are usually at low angles of inclination, while fossils are rare. It would seem probable that the conditions of deposit which prevailed in the carboniferous recurred at the commencement of the cretaceous, after a long continental interval.

The most important formation in Palestine is the great cretaceous limestone, overlying the Nubian sandstone, and constituting the mass of the hills of Judea, Samaria, and Galilee, while it extends northward into the Lebanon, and spreads itself on the south in the plateau of the Tih. This great calcareous formation corresponds in age to the chalk of Europe, and must be at least two thousand feet in thickness. Some difficulty has occurred in separating it from the Jurassic beds which underlie it in Hermon and Anti-Libanus, and from the eocene limestones which rest upon it in some parts of Palestine, and more extensively in Egypt. Our author does not deal very definitely with these questions, and indeed the sphere of his explorations was too limited to render this possible, except in the way of collating authorities.

The later tertiary deposits are not conspicuous in Palestine. Our author regards the calcareous sandstones of Philistia as being probably upper eocene; but the evidence which he adduces is not at all conclusive, and there seems quite as much reason to believe them to be a continuation of the miocene beds of the Isthmus of Suez, or probably of the still later isthmian series of that district. The evidence of fossils is wanting; and I am not aware of any miocene fossils in Syria, except perhaps in the conglomerates resting on the cretaceous in the vicinity of Tahleh in the Lebanon. On the whole, there can be little doubt that, as Hull believes, the miocene tertiary was in this region a time of shallowing water and of prevailing land conditions. This is well illustrated by the sandstones of Jebel Ahmar, near Cairo, and their petrified forests.

A number of interesting questions connect themselves with the great submergence of northern Africa and western Asia in the early pleistocene age, when Asia and Africa were separated by a wide channel, the valley of the Nile was an arm of the sea, the coast districts of Palestine were submerged, and a great lake or inlet occupied the Jordan valley. Hull illustrates this with a map showing the probable geography of this period. It is equally certain that this submergence was succeeded in the later pleistocene or postglacial period by an elevation of the land, when an inland lake receiving the waters of the Nile seems to have existed on the present isthmus. It is this second continental period which is connected with the first appearance of remains of man, — a subject in regard to which nothing new seems to have been observed. Other points of interest, and which Hull discusses at some length, are the great Jordan valley fault, throwing down the basin of the Dead Sea to a depth of 1,290 feet below the Mediterranean. The remarkable geographical features resulting from this great dislocation, the old marginal deposits of the Dead Sea, the hot springs on its borders, the salinity of its water, its climatic conditions, and its historical associations would open a field so large, that another article would be required for their discussion, more especially as there are points on which some difference of opinion may well exist.

THE collections made in the Bahama Islands by the naturalists of the fish-commission steamer Albatross contain several new species of birds and reptiles. There are two new woodpeckers of the genus Centurus, from the islands of Abaco and Watlings, or San Salvador, and two new warblers of the genus Geothlypis from Abaco and New Providence, while there are possibly some new races to be described also. Kirtland's warbler (Dendroeca Kirtlandi) was found on Watlings, Abaco, and Green Cay. Probably not more than half a dozen specimens of this species have hitherto been known. Another rarity was the Bahama cuckoo (Saurathera bahamensis), of which four specimens were obtained on New Providence Island. An apparently new species of blind worm (a peculiar family of snakes resembling worms, and covered with fish-like scales) is interesting as coming from a more northerly latitude than animals of this kind have yet been found in, having never before been taken in the Bahamas. The iguana was found in limited numbers on San Salvador. It is not known to exist on any other islands of this group except Andross. There are several valuable snakes in the collection, one being a very rare boa five or six feet long, from New Providence. There are many new species of lizards from Abaco and elsewhere. These shore collections were gathered at such times as the vessel anchored at suitable places, and are quite distinct from the dredging of fishes and marine invertebrates, the usual work of the vessel. There is the usual variety of undescribed and interesting material of the latter class, which appears to be inexhaustible. The winter cruises of the Albatross are undertaken with the co-operation of the fish commission and the hydrographic office, on account of the extensive series of deep-sea soundings that are taken for the latter department, and have proved of great value to this service.

SCIENCE.

FRIDAY, JUNE 18, 1886.

COMMENT AND CRITICISM.

THE INCREASED ATTENTION which is at present directed to artificial butter and its mixtures with dairy butter, and which has been aroused by the attempt of the dairy interest to secure national legislation to restrict the manufacture of oleomargarine and similar substances, makes a recent report of the Imperial health office at Berlin of great interest to the scientific and general public. The inquiry was undertaken at the demand of the government for the discovery of a butter substitute which should, through its cheapness and better keeping-qualities, prove desirable for the navy and the poorer classes. From a sanitary point of view, the report considers that the butter substitutes found in the market are harmless. In all the factories investigated the great cleanliness and care used seemed to make the manufactured article more appetizing than many dairy butters. It is, however, granted, that, when improperly prepared from fats of uncertain or unhealthy origin, there may be danger of the communication of disease: and it is not always possible to tell whether a fat is from a healthy source or not. Disease, it is true, may be communicated through the milk of an infected animal, but such a condition in a living animal is more readily detected. As the production of oleo-oil increases, the demand will exceed the supply, and compel the use of fat from doubtful sources. This, perhaps, already occurs in some cases. There are records of the discovery of bacteria and parasites in some butter substitutes, and the question arises whether the heat used at any time during the process of manufacture is sufficient to kill them. Low temperatures are the rule in most factories, and it appears that the possibility of injury to health from this source is not excluded. The substitutes can also contain ingredients which may prove injurious by loading down the intestines with material of no nutritive value. Soapstone-powder has been thus used for the purpose of giving butter additional weight. Coloring is only objectionable when poisonous dyes are used, but the same objections apply to the coloring of dairy butters as of substitutes. Aside from these injurious contaminations, the question of the sanitary quality of artificial butters must be decided by their relative nutritive value and digestibility as compared with the natural articles. This question, the report considers, is not yet settled from a scientific stand-point.

The conclusions derived from the investigations of this subject are stated as follows: "1. Artificial butter prepared from the fat of healthy animals, aside from a perhaps somewhat smaller digestibility in comparison with milk-butter, furnishes no occasion for the acceptation that it can act injuriously on human health; 2. It is possible that a part of the artificial butter found in the trade is prepared from such material, and by such methods of manufacture, as would not exclude, with certainty, the danger of the communication to human beings of diseases which can be produced by vegetable organisms or by animal parasites; 3. It is possible that some artificial butter is prepared from nauseous materials." It is therefore necessary that there should be strict regulation of the commerce in this article, although at present the means of bringing this about are doubtful. The methods of distinguishing between natural and artificial butters are reviewed at great length as being the basis upon which any regulation of the industry must be founded. The perfection of the recent processes of manufacture are such that these substances cannot, in most cases, be distinguished from each other by their external appearance, or by the senses in any way, without the aid of physical or chemical investigation. Of the physical methods which have been commonly applied, the report refers to those depending on the determination of the melting-points of the various fats, the specific gravity at certain temperatures, the appearance under the microscope, the examination with the refractometer, and a new method of Professor Mayer's. Almost all of these are considered to be of value only within certain narrow limits, as mixtures of fats and oils are found which correspond closely to pure butter. For the practical dairyman, the determination with the areometer, of the specific gravity of the fat melted at 100° C., is regarded as the most available test. While the test is not entirely satisfactory, and cannot com-

pare with those of a chemical character, it is apparently the only one which is available for use outside the laboratory. The differences in the specific gravities of different fats, which furnish the basis for distinguishing them, seem to be hardly great enough to detect mixtures of small amounts of oleo fat or oils with dairy butter.

THE REPORTS that announced the suicide of the King of Bavaria, at the same time brought the news of a sad loss to science. The physician of the king, Dr. Gudden, who lost his life in the attempt to save that of his charge, was one of the most noted authorities in the sphere of nervous and mental diseases. He has also been at the head of a laboratory in which investigations of the fine anatomy of the brain, spinal cord, and sense-organs have been carried on. He has given his name to a matter of studying the connections of the nervous system which is as ingenious as it has proved fruitful of results. Gudden's method consists in extirpating a sense-organ or other part of an animal when young, and then allowing the animal to grow up. At death the animal is examined, and the fibres which have failed to develop will thus be marked out as the paths of connection between the extirpated sense-organ and the brain-centre. For many years Dr. Gudden has been working at the problem, What is the mode of connection between the retina and the brain? His results are not yet before the public, but the great care and patience which always characterize his work will surely make them valuable. His loss in this difficult department of anatomy and pathology is a very serious one indeed.

ASPECTS OF THE ECONOMIC DISCUSSION.

WITHIN the past two months *Science* has contained three extended articles, in which, in compliance with the invitation of the editor, several distinguished members of the so-called 'new school' of economists have undertaken to set forth their principles. In compliance with a like invitation, I now present my views upon the aspect which the discussion has assumed.

If I rightly understand the case, the primary object of the discussion was to afford the representatives of the new school an opportunity to set forth such peculiarities of their tenets as might justify the appellation which they claim, and at the same time afford the student an opportunity to compare their principles with those of the school from which they are supposed to diverge. The main point in which the new school is supposed to differ from the other, is that it looks with more favor upon government intervention in the processes of industry and trade; and it might naturally have been expected that its representatives would define their position upon the questions here involved.

In this respect the outcome of the discussion is disappointing. After a careful study of the three papers already published, which bear directly on the subject, I am unable to form any clear conception of the ground taken by the writers on these fundamental questions. The form in which the question first presents itself to my mind is this: the familiar terms 'government intervention' and 'state interference' are themselves so vague, that in discussing them we must exactly define the sense we attach to them. There are two or three forms of state intervention. And it may be that one form is good, and another bad; that one form will inevitably tend to increase with the progress of society, and another to diminish. Again, we must draw a distinction between intervention in purely economic affairs for purely economic objects, and intervention for other and wider purposes, such as the promotion of education, the public morals, and the public health.

These definitions would only have been preliminary to the main object, which is to define to what extent state intervention can with advantage be carried. There can be no reasonable discussion over such vague propositions as, 'the state ought to interfere,' or 'the state ought not to interfere,' because every one is agreed that the state ought to interfere where it is really necessary to the public welfare, and that it ought not to interfere when it will not promote the public welfare by so doing. Again, when the state does intervene, it must intervene in the right way; and the question whether any particular way is or is not the right one must remain open until it is examined. The careful reader of the discussion will see that no progress whatever is made, in the articles alluded to, towards answering these fundamental questions: I am therefore obliged to consider in a general way such of the points brought forward as seem worthy of comment.

Professor Seligman's paper, on the changeable character of the tenets of political economy from age to age, seems to me a very admirable one. It shows very clearly the relations of economic theory to economic practice at various epochs in the world's history. It implies that the orthodox economic principles of the first half of the present century must pass away, as others have done, with changes in the forms of industry. While I heartily agree with nearly all that he says, when I am

allowed to interpret it in my own way, I yet fancy that I see in it an undercurrent of thought which conveys a false implication. Possibly I may make myself clearer by being allowed to intrude my own views of the abstract or so-called English political economy of the past generation. They may briefly be summed up in two propositions : —

First, this economic system has become entirely insufficient to satisfy the progress of the age, and does not furnish us the means of solving the new problems which now confront us.

Second, this same system is a most necessary part of sound economic teaching, and embodies the principles which the public now most need to understand.

If the reader now sees any thing contradictory in these two propositions, I beg him to compare the following illustrations of their relation. I have a carefully built roadway from my house to a city five miles away, part of which comprises costly bridges over streams and ravines. In the course of events the city is moved five miles farther on, so that my road only carries me half-way to it. I can now say of the old road just what I have said of abstract or mathematical economy, that it is totally insufficient for my purpose, and yet is most necessary to enable me to reach the city. My wise course is not to tear down the road as useless, but simply to extend it farther on. If I employ men to build the extension, and at the same time denounce the old road as a nuisance in such strong terms, that, on going out next morning, I find my men have blown up all the costly bridges in obedience to my supposed wish, I will have made a great mistake. The fact is, I do not want a new road, but an extension of the old one to suit the changed conditions.

Professor Seligman says that we are compelled to regard much that was at the time probably correct and feasible, as to-day positively erroneous and misleading. Now, I regard this statement as itself misleading, being true or false according to the way in which it is understood, and as more likely to be understood in a false sense. Whether such doctrines as we meet with in economics will prove feasible or misleading depends upon the way we interpret and apply them rather than upon the doctrines themselves. The doctrine that a straight line is the shortest distance between two points is, abstractly considered, always true. It teaches us, that, other conditions being equal, a straight road between two points is the easiest. If we apply it to cases in which the different roads we may take to our destination are all alike except in their directness, we shall apply it correctly. But if, blindly following it, we pursue a perfectly straight road which is very bad and rough, in preference to a crooked one which is hard and smooth, we shall make a great mistake. Are we, then, to denounce the doctrine as false and misleading? If we did, we should only act on the same principles upon which three-fourths of the critics of the older political economy act. Considered in the concrete, every general proposition is true or false according to the circumstances. Practical wisdom consists in selecting such propositions as apply to the case in hand. It seems to me that abstract English political economy, as I find it in the text-books, contains a number of great and valuable truths applicable to the present state of society, mixed with a quantity of matter which can be made useful only by reconstruction. In the latter category I include the leading propositions about profits, wages, demand for labor, the wage-fund, and the functions of a paper currency. In a word, economic principles should be looked upon as the tools of trade of the economist, to be used as occasion offers to make them useful.

Professor Ely's paper opens with a most timely exposition of the necessity that disputants should begin by understanding each other's position. I have often suspected disputants of deeming it highly impolitic to define their position on the points under discussion, because, when they do so, they have to stand there to be fired at, while by refraining from it they can step around briskly in such a way as to dodge all the enemy's shots. Professor Ely goes on to take exception to the statement that economic science should not concern itself with what ought to be. The question here raised is one which we can decide either way with equal correctness, according to the view we are to take of the scope of science. If we confine the word 'science' to what I think should be its proper scope, it is a contradiction in terms to call a talk about what ought to be, science. In the proper sense of the term, science consists of exact and systematized general knowledge; and the great difficulty with Professor Ely's extension is, that it tends to increase the prevailing confusion in men's minds between talk about things as they are, and about things as we would like them to be. I see no more logical objection to building up a science of political economy which shall be wholly concerned with things as they are, especially with the relations of cause and effect in the commercial world, than I do to getting up a guide-book showing how long it takes different ships to cross the Atlantic. On the other hand, I would no more consider this the end of the matter than I would consider the guide-book as the only one the tourist should read. The economic student is no doubt very much interested in what ought to be, and, in

fact, this may be the object of all his economic studies.

Why, then, should we not allow the economic student to consider things as they are, and things as they ought to be, altogether? I reply, the reason is that he is thus led into a confusion of thought which is fatal to his success. I find that men continually think we are talking to them of things that ought to be, when, in fact, we are only talking of things that are or would be. Indeed, from what little I have seen of men and their ways of reasoning, I am inclined to think that one of the most difficult pieces of mental discipline is that of learning to look upon facts simply as facts. Times without number I have seen educated men refuse to accept a statement of fact, not on the ground that it was not a fact, but that it was not *necessarily so*, or *might* be different, or *ought* to be different. I should be very sorry to see any teacher foster this mental weakness; and I see no way to cure it except to say to the student, 'Now, remember that I am only telling you facts and results.'

Passing on to what ought to be, Professor Ely sets forth in detail the ethical idea which animates the new political economy. He thinks that economists, like everybody else, should strive after perfection. In this I do not think he will find any to disagree with him. When he tells us what we are to do to bring about the rational perfection which he is aiming at, there may be differences of opinion; but, when he thinks that he sees any great divergence between his views and the popular ones which he cites, I cannot but think he is mistaken. For example: he tells you, that, if you listen to two ladies discussing the education of the serving-class, you will find that the arguments all turn upon the effect thereby produced upon them as servants. But is it not highly probable, that, taking these people as they stand, their development into good servants is the highest and most rational of which they are capable? Would he have Cuffee trained into a novelist, a chemist, or a metaphysician? Is it not highly probable that that being does more good, both to himself and to society, by being a thoroughly good servant than he would by being the very best mathematician which he was capable of being? If so, then there is no antagonism between the selfish housewife and the philanthropic professor.

Again, he cites Renan as calmly assuring us that forty millions may well be regarded as dung did they but supply the fertility which will produce one truly great man. It seems to me that this remark is too figurative to base any discussion upon. It indicates no definite policy towards the lower classes, and only gives voice to the feeling that one great man may be more important than millions of the lower orders of men.

It seems to me these remarks of Professor Ely savor much more strongly of the doctrines of individualism, which he vigorously opposes, than of those of the socialistic school of which he is so distinguished an expounder. If I rightly understand the ground taken by the last-named school, it is that the interests of the individual should be held subordinate to those of society, and that the prosperity of society should be the first object of the economist. Accepting this view, it follows that the education of the masses should be directed by considerations based less upon the wants of their members as individuals than upon the wants of society at large, future as well as present. If, now and during the next hundred years, society stands more in need of great leaders of thought, administrators, and expounders, than it does of servants and mechanics, it follows, from the socialistic point of view, that our efforts should be directed to the rearing of such men rather than to the education of the masses in subjects that will not make them better citizens.

One would infer from Professor Ely's paper that a very serious question at issue between himself and the older school of economists is whether ethical considerations should be allowed to obtrude themselves into questions of economic policy. I think a careful review of the ground taken by the new school will show that it is his school which is most prone to reject such considerations. For example: in the case of free trade it is very common for representatives of the school of governmental interference to claim that freedom of trade is founded on the idea that the interests of humanity at large should be taken into account in deciding the question. In opposition to this, they claim that we should consider our own interests exclusively. Again: the claim that every individual has the right to be the sole master of his own acts, within the limitations necessary to social order, is a purely ethical one; yet no doctrine of the old school is more vigorously assaulted by the new school.

The fact is that Professor Ely, in the following passage, gives an admirable statement of the doctrine of the school of individualism, to which he professes a bitter opposition: —

"It is well to describe somewhat more in detail the ethical ideal which animates the new political economy. It is the most perfect development of all human faculties in each individual, which can be attained. There are powers in every human being capable of cultivation; and each person, it may be said, accomplishes his end when these

powers have attained the largest growth which is possible to them. This means any thing rather than equality. It means the richest diversity for differentiation accompanies development. It is simply the Christian doctrine of talents committed to men, all to be improved, whether the individual gift be one talent, two, five, or ten talents. The categorical imperative of duty enforces upon each rational being perfection after his kind."

The school of non-interference claims, that, as a general rule, these ends are best attained by giving the adult individual the widest liberty within the limits prescribed by considerations of public health and morality.

After following the discussion so far upon the lines it has already taken, I deem it right to bring out in strong relief what is the real gist of the question. What advocates of non-intervention by government base their policy upon, is neither an abstract theory of society, nor a system of ethics, but a practical business view of things. As matters now stand, government ought not to interfere, for the simple reason that the policy and acts to which it would be led are not founded on sound business principles. I have myself been a careful student of the treatment of economic questions in congress during the past thirty years; and the general outcome of all I have seen is, that, leaving out legislation on well-marked lines for the supply of obvious public necessities, no really wise economic legislation by congress is attainable. Congress is not, and in our time cannot become, a body of investigators or theorists. Within a certain field I regard congress as an excellent representative of the wisdom of the nation; but it goes outside of that field when it considers economic theories. It then becomes the representative of the time-honored fallacies of the people rather than of their wisdom. If any one doubts this, he has only to look upon a few shining examples now before us.

The nation at large looks with regret upon the decline of American shipping, which has been going on ever since the civil war, and earnestly desires that we should have a mercantile fleet sailing the ocean under the American flag. Now, what measures have our legislators taken to bring about this result? They are in their main features as follows: —

First, that no American owner of a ship shall be allowed to sail her under the American flag unless she was built in the United States.

Second, that no person shall be allowed to build a ship within the United States unless he pays a heavy penalty, called customs duty, on all the machinery and raw material which he may find it advantageous or necessary to import for the purpose. In the case of a large ship-yard, this penalty may amount to hundreds of thousands if not a million of dollars. Possibly no one in the United States would make the machinery on any terms whatever, and possibly some of the material may be monopolized by a single company or combination; but the penalty is exacted without regard to circumstances.

Third, that, after the ship is built, its running shall be subject to certain restrictions, of so onerous a character, that after paying all the penalties, and going to all the labor of building the ship, the owner will run her at a loss when he could make a profit by sailing her under a foreign flag.

In brief, our legislation has thrown positive obstructions in the way of any ship being run under the American flag. The only remedy that the promoters of this legislation have offered us is that of hiring American shippers by heavy subsidies to overcome the obstacles which we have thrown in their way. Everybody who chooses to look into the subject can see that, in order to secure an American mercantile marine, all we have to do is to repeal all laws throwing obstructions in the way of Americans building, owning, and sailing ships, thus allowing every American citizen to get his ship where he pleases, to build her as he pleases without interference from customs authorities, and to sail her without vexatious regulations.

The proof of this is afforded by the fact of ownership of foreign lines by American companies at the present time. For example: the well-known Red Star line between New York and Antwerp, which the reader constantly sees advertised in the New York papers as sailing under the Belgian flag, is really owned and managed by an American company. This company calls its ships *Belgian*, and sails them under the Belgian flag, simply because our laws do not allow them to sail under the American flag. The same thing is partially true of the well-known Inman line between New York and Liverpool, and, to a less extent, of the Guion line. I cannot speak accurately on the subject of these last two lines, but my impression is that American enterprise is gradually getting possession of them.

I wish very much *Science* would induce our new school of economists to give their frank opinion of this policy. They might at the same time tell us what they think of the economic soundness of the principles on which the oleomargarine bill was sustained. I refer more particularly to the doctrine that it would be a great public calamity if the public of this country were allowed to get their butter for seven cents a pound, because then all the dairies would have to stop business. The total failure of congress not only to remedy the

present anomalous condition of the silver coinage, but even to take any rational measures for finding out what ought to be done in the case, is another subject on which their views would be of interest. I cannot help thinking, if they would grapple with these practical difficulties, and tell us what wise and good legislation they expect to get through congress, they would be more effective than they are in confining themselves to discussions on which no effective issue can be joined.

S. NEWCOMB.

FLOODING THE SAHARA.

MUCH misinformation has of late been spread abroad respecting 'the proposed interior sea of Africa,' and the public has been misled by inaccurate statements in regard to the magnitude of the enterprise, which, it is assumed, the French people are about to undertake. For these current erroneous impressions the English and American scientific journals are largely to blame. An old theory regarding the Sahara — that it was for the most part below the level of the ocean — has been adopted as though modern surveys had not refuted it; and so the conversion of a material portion of the African continent into a navigable sea is being popularly considered as not only possible, but altogether likely to be accomplished.

A brief consideration of the published results of the recent surveys will be sufficient to convince the reader that the popular estimate of the magnitude of this enterprise is absurdly out of proportion to the greatest possible accomplishment.

This overestimate is not surprising when we consider the character of the references to the scheme which have been made by journals of the best standing. The following paragraph from the foremost among engineering journals may be taken as a sample: —

"With reference to the daring French project for flooding the desert of Sahara with what would be virtually a new sea, it may be well to recall the opinion expressed by M. Elisée Réclus, that at one period in the world's history the desert was covered by a sea very similar to the Mediterranean, and that this sea exercised a very great influence upon the temperature of France, as comparatively cold — or, at any rate, cool — winds blew over it, while now the winds which prevail in the great expanse are of a much higher temperature, and are, in fact, sometimes suffocatingly hot. The appearance of the desert seems to support the theory of M. Elisée Réclus, that it was at one time the bed of a sea of considerable extent, of which the great inland African lakes recently discovered are possibly the remains. The present vast extent and configuration of the African continent would also appear to support the conclusion that at one time it comprised a less area of land than it does at present. The serious question which arises, assuming that the theory of M. Elisée Réclus is substantially correct, is, What will be the effect of the creation of a second African sea in the room of that which has disappeared? Would the temperature of France, and possibly even of England, be again reduced? It is a geological theory that in the glacial period of the world's history Great Britain was covered with ice and snow very much as Greenland is at present. Some great influences must clearly have been brought to bear upon France and Great Britain, which rolled the ice over so many hundred miles northward. What was this influence? Was it the large African sea which French enterprise is endeavoring to recreate? If it were, we should say that whatever the French may gain in Africa by the realization of a Saharan Sea would be much more than counterbalanced by what they would lose in France itself."

A writer in another journal suggests that all nations interested in the commerce of the Mediterranean may by right protest against the execution of a scheme that would produce a troublesome current through the Straits of Gibraltar. And the same writer, furthermore, adds, "So much water drawn from the present oceans, may, by lessening the depths of the harbors of the world, produce serious and wide-spread inconvenience."

That all such fears are utterly groundless is abundantly shown by the results of the careful surveys made within the last few years. A brief *résumé* of these results is presented below. The figures are reduced from the metric measures in 'Nouvelle geographie universelle,' by Réclus, and the maps from 'Le génie civil.' In both cases the authority quoted is the French engineer, M. Roudaire.

Every one who, as a student, has had to draw the map of Africa, can certainly recall that singular interruption to the otherwise regular coast-line on the extreme northern boundary, where the coast, for a comparatively short distance, has a general north and south trend. This notch marks the north-eastern terminus of the Atlas mountain system. The eastern shore is the eastern boundary of Tunis; and on it, in ancient times, stood Carthage. An indentation at the southern part is called the Gulf of Gabès.

A line extending due west from the shore of this gulf crosses a barren region, of no interest but for the project about which this article is written. It is a region abounding in basin-shaped depressions, containing either shallow salt-marshes,

PROPOSED INLAND SEA IN ALGERIA.

brackish pools, or deposits of salt and gypsum. The more extensive areas are called 'chotts.' The first of these is the Chott-el-Fedjedj, the eastern end of which is 12 miles from the shore of the gulf, and separated from it by a ridge of drift and limestone whose altitude at the lowest point is 150 feet. The surface of el-Fedjedj is nowhere less than 48 feet above the sea. Toward the west it is contracted in width somewhat by the encroachment of the ridges which bound it on the north and south. Beyond this point, which is about 70 miles from its eastern limit, it widens out, and is known as Chott-el-Djerid. Here the surface is for the most part level, and covered with an incrustation of salt, beneath which, in a few places, are pools of water. The plain of el-Djerid is from

MAP OF AFRICA, SHOWING THE RELATIVE SIZE OF THE PROPOSED INLAND SEAS.

50 to 200 feet above the sea-level. Its width from north to south is about 45 miles.

Near the north-west border of el-Djerid, and separated from it by a ridge whose least altitude is 550 feet, is the Chott Gharsa or Rharsa, whose surface is from 30 to 35 feet below the level of the sea. Gharsa is about 50 miles long and 20 miles wide. Beyond this chott to the west, and separated from it by an insignificant elevation, is a much larger depressed area, known as Chott Melghigh or Melhrie. This is the basin referred to as the site of the proposed interior sea. The area which, lying below the Mediterranean, can possibly be flooded by it, is represented by the shaded portion on the accompanying maps.[1] Portions of this area are 100 feet below the sea-level; and the average depth, if flooded, would be 78 feet.

[1] The scale of the larger map is about 58 miles to the inch.

The figures above given exhibit the possible dimensions of the 'flooded Sahara.' The united areas of the two chotts over which the sea would flow is, by Roudaire's measurements, about 3,100 square miles, less than half the area of Lake Ontario.

Throughout the remainder of the Great Desert the elevation is considerable. Competent authorities estimate the average height at 1,100 feet. Dr. Lenz found, in travelling over many hundred miles of the western portion of the Sahara, no point of less altitude than 470 feet above the sea.

The fact that marine deposits are found in many parts of this area is, of course, a fact of no significance in this connection. The skeleton of a whale found in one of the highest cuttings of the Vermont central railway is not regarded as an evidence that the Green Mountains could now be submerged by the waters of the ocean.

The whale probably stranded there during what geologists term the 'Champlain epoch,' since which time the surface has slowly risen. The hypothesis that at least eighty thousand years have elapsed since this epoch is believed by most geologists to be well founded. Explorations across the African desert justify the belief that the marine deposits found there are not less ancient than those of the Champlain period.

To flood such a section with the sea, either the next great subsidence must be patiently awaited, or else an extensive system of pumping must be resorted to. The realization of the scheme of submergence (to accord with the popular estimate of it), by either of these plans, may be regarded as equally remote.

The project of flooding the Sahara to the utmost practicable limit can hardly be called a great one. It is safe to say, that if executed, which is doubtful, it will not sensibly affect the climate of southern Europe. It will not create dangerous currents at Gibraltar, nor inconvenience seaports in any part of the world. GEO. W. PLYMPTON.

LONDON LETTER.

A SUGGESTIVE report by Mr. W. H. Power, of the Local government board, has just been published, relative to the connection between scarlet-fever and infected milk, — a connection which has long been suspected. The farm in question was sanitarily perfect, every modern improvement in respect to cleanliness of vessels, and examination of persons employed, being in force. Mr. Power was assisted in his investigation by Dr. Klein; and their joint results leave little or no

doubt that the cows of the dairy were infected with a specific disease of a constitutional character, whose local manifestations were external sores on the animals, and that the milk from these cows was capable of imparting scarlatina to human beings, and was the real cause of an epidemic of scarlatina in a large district (Marylebone) in London. Two of these animals were purchased for the Brown institution (established in connection with the University of London for the investigation of animal pathology); and the exact nature of the diseased milk is still being inquired into by Dr. Klein.

The ensilage commissioners have just issued their complete parliamentary report, one of the most valuable documents ever put into the hands of the English farmer. They have gone about their work in a thoroughly judicial spirit, and the result of their inquiry is to establish the use of the silo as an essential part of the procedure of successful agriculture. Green forage well preserved in a silo is, weight for weight, one-third of the same forage made into hay; but, as the weight of the most perfect silage is five times that of the hay, it is sixty per cent more valuable. The full conclusion of the commissioners can best be expressed in their own words: "After summing up the mass of evidence which has reached us, we can without hesitation affirm that it has been abundantly and conclusively proved to our satisfaction that this system of preserving green-fodder crops promises great advantages to the practical farmer, and, if carried out with a reasonable amount of care and efficiency, should not only provide him with the means of insuring himself to a great extent against unfavorable seasons, and of materially improving the quantity and quality of his dairy produce, but should also enable him to increase appreciably the number of live-stock that can be profitably kept upon any given acreage, whether of pasture or arable land, and proportionately the amount of manure available to fertilize it."

The deputy master of the mint has just issued his report for 1885, a document of much interest. The coinages required by the English colonies were more numerous than, and exceeded by £85,000 in amount, those of any previous year. This is attributed in great measure to the depression in the West Indies. The balance of receipts over expenditures was more than £70,000, one of the expenses being the preparation of medals for troops engaged in suppressing the Canadian rebellion. Mr. Fremantle reports, that "although during the year 1885 a considerable amount of coinage has been executed in the British and United States mints, and in those of some European nations, hardly any addition has been made in several countries, and notably in France and Germany, to the metallic currency of the world;" and also that "the questions connected with coinage, which have of late years been discussed with the greatest interest, have not made any appreciable progress toward solution."

A large private electric-lighting installation has just been inaugurated at the London terminus of the Great western railway. The whole district lighted is 1½ miles long, and covers 67 acres of ground; 4.115 glow-lamps of 25 candle-power each are used, 93 arc-lamps of 3,500 candle-power, and 2 arc-lamps of 12,000 candle-power. The two dynamos employed are those of Mr. J. E. H. Gordon, and weigh 45 tons each, one-half of which is due to the ten-foot revolving magnet wheel, which runs at 146 revolutions per minute. The electromotive force is 150 volts. The mains are all underground, and the glow-lamps are all in parallel arc. Two lines of steam-pipe supply the engines, and a third dynamo is kept in reserve. The Telegraph construction and maintenance company have contracted with the railway company to work it for three years.

At the last meeting for this season, of the Society of telegraph engineers, etc., about thirty-five candidates were elected into the society. There was an interesting discussion, in which Dr. Jacques, electrician to the Bell telephone company, U.S.A., took part, on the use of the telephone as a receiving-instrument for Morse signals in warfare, and on the general military question of recording *versus* non-recording receiving-instruments.

In continuation of brief comments upon exceptional weather in Britain, which have appeared in this correspondence, it may here be mentioned that from May 11 to May 15 the mean temperature was from 6° to 8° below the average; and that torrents of rain fell over a very wide district, more than four inches in three days (11th, 12th, and 13th) being not uncommon. The valleys of the Severn and Trent suffered severely, railway traffic being suspended, and many inhabitants driven from their homes. Severe tornadoes occurred at Madrid, Krossen, Linz, and other European towns, two or three days after those in Kansas City and other parts of the states.

English pathology has suffered a severe loss by the death, at the early age of forty-five, of Surgeon-Major T. R. Lewis, the assistant professor of pathology at the Army medical school. He had made a special study of microscopic organisms and their relations to disease, and was the author of several most valuable reports to the government of India on cholera and the fungus disease of India. In the autumn of 1884 he visited Mar-

seilles, where cholera was then prevalent, for the purpose of investigating the results obtained by Dr. R. Koch and the other members of the German cholera commission in Egypt and India; and he arrived at the conclusion, which is now widely accepted, that the selection of the comma-shaped bacilli as the *materies morbi* of cholera appears to be entirely arbitrary, for he found that these comma-shaped bacilli are ordinarily present in the mouths of perfectly healthy persons.

The value of Professor Lewis's biological work was recognized by the council of the Royal society when they selected him, in April last, as one of the fifteen candidates to be recommended to the society for election in June: and his death thus leaves a vacancy in the list, which it is said the council will now fill up by the selection of Mr. A. Sedgwick, M.A., of Trinity college, Cambridge.

Mr. W. H. Caldwell of Cambridge, who has spent some time in Australia for the purpose of obtaining the material required for investigating the embryology of marsupials, monotremes, and Ceratodus, exhibited some of the results of his work at the recent Royal society *soirée*. It will be remembered that a telegram was sent to the Montreal meeting of the British association to announce his discovery of the fact that the eggs laid by the monotreme mammals developed in a manner closely similar to those of the Reptilia. Series of these mammalian eggs were exhibited by Mr. Caldwell, some taken a few hours after fertilization, with others at various stages up to hatching, and likewise different stages of the young after hatching, up to five inches long. He also showed a complete series of eggs of Ceratodus, the air-breathing fish of Queensland, from the unsegmented egg up to hatching, together with stages of the young fish after hatching. All this material is of the highest value, and Mr. Caldwell's researches are sure to throw much light upon many obscure problems of vertebrate morphology. He will also be able to supply Prof. W. K. Parker with the specimens necessary for investigating the development of the skull in Ceratodus, Echidna, and many marsupials. W.

London, May 30.

NOTES AND NEWS.

THE first circular of the local committee at Buffalo, of the American association, announces that the meetings will be held in the recently enlarged high-school building. Reduced rates have been obtained over many of the railroads, most of which will allow a return ticket at one-third of the usual fare, upon certificate from the local secretary at Buffalo. The Chicago and north-western railway system will return members attending the Buffalo meeting, from Chicago, at one-third of the regular fare, upon presenting at the Chicago ticket-office a certificate from the local secretary at Buffalo: hence members residing in the north-west must see that they are in possession of two certificates when the meeting adjourns, — one to be used in Buffalo, and the other in Chicago. The Western union telegraph company, with its usual courtesy, will place its lines and district telegraph system at the service of members. The Botanical club of Buffalo is arranging an excursion and reception for the Botanical club of the association, as is also the Entomological club of that city for the Entomological club of the association. The address of the local secretary is Dr. Julius Pohlman, Buffalo, N.Y.

— The Appalachian mountain club propose issuing advance sheets of the forthcoming White Mountain map on a scale of 1:50000 by tracing the work now done, lettering the tracing roughly, adding the streams approximately, and copying by the 'blue print' process. Two sheets, a northern and a southern, will together cover the most important areas. It is hoped to have them ready by the first of July, and the cost is not likely to exceed seventy-five cents per sheet. Members may thus obtain maps of the accurately located points (including nearly all marked summits), on which they may fill in the lesser details, and mark corrections of the streams. Artistic appearance will not be attempted for these sheets; but their practical value will lie in the large scale, which is twice (linear) that on which the finished map is to be published. A field-meeting will be held on the summit of Mount Washington from July 1 to 8. Papers may be expected from Profs. E. C. Pickering and N. S. Shaler, Dr. W. G. Farlow, Messrs. J. Rayner Edmands, Rosewell B Lawrence, and others. The papers will be arranged for stormy weather and the evenings.

— Yale college, induced by the success of the Columbia college school of political science, and by the work in progress at Johns Hopkins, Cornell, and the University of Michigan, is making special arrangements for courses in political and social science, to begin in the autumn. Professor Sumner is announced to lecture on finance and the science and art of politics in the history of the United States; Professor Farnam, on the principles of public finance; Professor Hadley, on railroad administration: Mr. Wheeler, on Roman law; Mr. Terry, on the doctrine of rights; Mr. Raynolds, on comparative constitutional law; Mr. H. C. White, on local government in the United States; and Mr.

E. G. Bourne, on a view of trade and industry in Europe in the middle ages.

—On Aug. 25 next, Prof. Edward Zeller of Berlin will celebrate the fiftieth anniversary of the attainment of his doctorate. The many old pupils and friends of the learned historian and philosopher intend to present him on this occasion with his picture or bust, as a slight mark of their appreciation of his services to the cause of human knowledge. The movement was started in Berlin by some of Professor Zeller's associates, and the original announcement of their intention is signed by Bonitz, Dilthey, Eucken, Erdmann, Kuno Fischer, Helmholtz, Kronecker, Mommsen, Max Müller, Von Sybel, and many others. The names of all those who contribute to the fund will be communicated to Professor Zeller, and it is hoped that America will be well represented. Contributions may be sent to Prof. T. G. Schurmann, 15 West 57th Street, New York City, or to Prof. Nicholas Murray Butler, Columbia college.

—M. Ch. Bouchard has recently supplemented his observations on the toxicity of urine by the following ones. The increase in the production and elimination of the poison begins immediately after rising, and commences to diminish at about the middle of the waking period. Abstinence from liquids increases the toxicity, owing to the superabundance of incompletely oxidized matters excreted. Severe muscular labor notably, sometimes to the extent of nearly one-half, diminishes the toxicity, not only in the waking state, but also in the succeeding period of sleep. Compressed air diminishes immediately and markedly the toxicity, to be more largely increased afterward.

—Recent examinations of the bottom of the Lake of Constance and of Lake Geneva by Hörnlimann have brought out the interesting fact that the Rhine and Rhone rivers have excavated deep channels for long distances. The current of the Rhine can be followed for two kilometres, at a depth of one hundred and twenty-five metres below the surface of the water; while that of the Rhone has been traced more than six kilometres from the mouth, at a depth of between two hundred and two hundred and fifty metres.

—The production of gold in the gold-fields of the Australian colonies during 1885 reached in value £5,831,468. The total amount from the year of its discovery to 1886 is 79,194,094 ounces, valued at £310,865,718. There has been a considerable decrease in production during late years.

—The natural-history section of the Imperial Russian geographical society has decided to send an expedition, during the present year, into central Asia, to explore the region of Khan Tengri, which has never been visited by European travellers.

—The statement in *Science* (vii. No. 174) that Prof. C. U. Shepard presented his cabinets to Amherst college was not strictly accurate. In accordance with an agreement of long standing, the college purchased his collections, and paid forty thousand dollars for them.

—Lieutenant Greely, the arctic explorer, who is entitled to his promotion to a captaincy in the U. S. cavalry in consequence of the retirement of General Sturgis, is not likely to be appointed to the vacancy in the adjutant-general's department, and it is possible he will not be promoted at all on the active list, for the reason that he has declared himself, undoubtedly with justification, unable to render active service. The generous thing for congress to do is to provide a place on the retired list, with ample rank, for Lieutenant Greely, in honor of his services and sufferings in the arctic regions.

—The new scientific building of Smith college, Northampton, Mass., will be dedicated Tuesday, June 22. The address will be by Prof. J. Peter Lesley.

—The extreme delicacy of the sense of smell in man has been shown by a series of experiments by Messrs. Fischer and Penzoldt. In an empty room of 230 cubic metres capacity, and tightly closed, a small quantity of the substance to be detected was thoroughly mixed with the air, and the observer then admitted. Among different substances it was found that the smallest amount recognizable was .01 of a milligram of mercaptan. This quantity diffused through the room sufficed to make its distinctive character appreciable in the small volume of air coming in contact with the nerves of the nose, from which it was estimated that the 1 : 460,000,000 part of a milligram of this substance was recognizable. Hitherto the spectroscope has been considered the most delicate of all means of analysis, indicating less than the millionth part of a milligram of sodium; but the sense of smell, in the case of mercaptan at least, is seen to be at least two hundred times more delicate.

—Prof. S. F. Baird, U.S. commissioner of fish and fisheries, has recently received from the Department of fish-culture of the lower Seine, France, a gold medal as an acknowledgment for some valuable sendings of fish ova. The medal was designed by Oudine. On the obverse is represented a female head bound with a chaplet of cereals. Legend: 'Republique française.' On

the reverse is inscribed "M. Spencer F. Baird, United States commissioner of fish and fisheries," and the legend "Department de la Seine-Inferieure. La commission de pisciculture. 30 Novembre, 1885." The medal is about the size of a double eagle. It will be placed on exhibition in the north hall of the national museum.

— M. Charpentier, in a late session of the French academy, called attention to the following visual illusion: after a small, feebly illuminated object has been attentively viewed for some time in complete darkness, it will often appear to move in some determined direction in the field of vision, at a speed varying from two to three degrees per second, and sometimes through a distance subtended by an angle of thirty degrees or more. M. Charpentier states that this illusion occurs in the fixed eye observing a fixed point, but it is doubtful whether he is correct. Muscae volitantes, or floating spots due to impoverished blood or disease, have a like tendency in the closed eye, when attention is directed to them, of moving off in some determined direction, apparently as if floating upon the vision; but a finger placed upon the eyeball will at once detect that the spots are fixed upon the retina, while it is the eye itself that moves.

— A recent examination of the employees of certain French railroads for color-blindness, made in compliance with the instructions of the minister of public works, resulted in the detection of only two persons who were totally color-blind among 11,173. Three could not distinguish red, six green; eighteen showed a confusion in distinguishing between green and red, fifteen a like confusion between blue and gray; and fifty-two had a feeble sense of colors in general. These results show that the danger arising from color-blindness, on the French railroads at least, is almost *nil*. As is seen, not more than two per cent of the employees had imperfect sight, so far as colors in general were concerned, and not more than a half of one per cent were troubled with color-blindness in any way.

— During the year 1885 there were 155,177 German emigrants from the ports of Hamburg, Bremen, and Stettin, a decrease of over 40,000 from the preceding year. Of this number, 148,-839 were immigrants to the United States.

— The coast-survey changes since our last issue are as follows: the party in charge of Assistant F. W. Perkins has returned from the south coast of Louisiana. The latter has gone to his home to work up the results of the trip; Captain Vinal has finished the gap on the west coast of Florida in Hernando county (this completes the ocean shore-line of that coast, except a small strip near the Thousand Islands); Assistant Pratt, who is on the north-west Pacific coast, reports the government telegraph-line from Tatoosh Island to Port Angeles, Washington Territory, as so badly grounded that it is impossible to exchange time-signals for longitude over it.

— The Zuni maiden Wa-Wah, who has been in Washington as the guest of Mrs. James Stephenson for several months, is now engaged in weaving a blanket in the national museum, on the loom procured by that institution from the Zuni Indians. The loom, with the blanket upon it, will be placed in a case in the museum, together with photographs of Wa-Wah at work upon it, which will illustrate the mode of weaving employed by the Zunis. Wa-Wah is well versed in all the mysteries of the Zuni religion and the customs of her people, and has given Mrs. Stephenson and the museum authorities much valuable information. She took great interest in the model of the town of Zuni at the museum, and gave testimony of its accuracy by pointing out her own house. She will go back to her home in the Zuni country with the geological-survey party, who will visit that region next month.

— M. Tourette has recently published certain results of observations on the gait in walking, in health and in various pathological states, which are of interest. The average full or double normal step he finds in the adult man to be sixty-three centimetres; in woman, fifty centimetres; in both sexes the right step is a little longer than the left. The average separation of the feet, or the base of support, in man in walking, is from eleven to twelve centimetres; in woman, twelve to thirteen; in both sexes the lateral distance being one centimetre greater on the left side. The sum of the divergence between the axes of the feet and the axis of direction is, in man, thirty-one or thirty-two degrees, the angle being about one degree greater on the right side; in woman, thirty or thirty-one degrees, with one or two degrees greater divergence. In one of the pathological types occurring in locomotor ataxia, in paralysis agitans, etc., the step is smaller, and the distance between the feet as well as the angle between them is larger, than normal. Another type, seen in diseases of the spinal cord, hemorrhages of the cerebellum, and in vertigo, shows a zigzag manner of walking. The step may be either short or long: in either case the footprints are confused and indistinct, and deviate from the line of walking. Other differences have been wrought out. Perhaps the most unexpected

result was that the pathological step is more regular than the normal in all the points above noticed. In other words, in the normal walk it is the man himself who is walking, and his natural variations appear: in the other the disease does the walking, and the step is marked by the constant symptoms of his malady.

— Advices just received from Mr. William T. Hornaday, who was sent out by the national museum in search of buffalo, are to the effect that he has secured two antelopes; he has also sent to the museum three complete skeletons of old bull-buffaloes, and two skulls.

— The *Iron trade review* estimates that the quantity of domestic iron ore used in the blast-furnaces, rolling-mills, and forges of the United States in 1885 was 7,600,000 gross tons.

— Anatomists were considerably startled some time ago to learn that Professor Hamilton had discovered that the corpus callosum was not a commissural structure at all, but represented the decussation of fibres on their way from the cortex to lower parts. Almost every thing has been doubted in the anatomy of the brain, but the corpus callosum has always been regarded as a system of fibres whose connections and functions were rather definitely known. In a recent article (*Brain*, April, 1886), Dr. Beevor shows conclusively that our faith in the corpus callosum may remain undisturbed. The sections figured in his plate distinctly represent the fibres of the corpus callosum intersecting, and in no way joined with the fibres of the internal and external capsules. He answers Professor Hamilton's morphological argument that some animals exist without a corpus callosum by pointing out that in those (marsupials, for instance) the anterior commissure becomes proportionately developed. Dr. Beevor concludes then that the current view of the connections of corpus callosum and of the internal capsule are perfectly correct.

— That frogs have a formidable enemy in the common mouse is evidenced by the following. A correspondent of *Nature*, Mr. W. August Carter of South Norwood, states that he observed, a short time since, several mice pursuing some frogs in a shed which was overrun with these reptiles. The alacrity of the latter, however, rendered the attacks of the mice futile for a considerable period. Again and again the frogs escaped from the clutches of their foes, but only to be recaptured, severely shaken, and bitten. The energy put forth by these reptiles was so great that they actually swayed their captors to and fro in their efforts to wrest themselves from their grasp. At length the wounds inflicted upon them rendered the frogs incapable of further resistance, and they were easily overpowered by the mice, which devoured a certain part of them.

— In 'Flowers, fruits, and leaves,' by Sir John Lubbock, Bart. (*Macmillan*), we have a popular, readable, and withal scientific account of many of the phenomena of fertilization of flowers, of the structure and varieties of seeds, and of many of the endlessly varied forms of leaves with which vegetation is covered. The first two chapters, on flowers, are a reprint, with some emendations and additions, from a previous volume by the distinguished author, and deal principally with the modes of fertilization, showing how, in many cases, appropriate insects are enticed into doing this important work, while other insects, not adapted to the work, are repelled or excluded from access to the flower. The next two chapters treat of fruits and seeds, and of their development and protection, and the modes of dispersion adapted to the habits and habitats of the plants in which they originate; while the last two chapters, on leaves and the varieties in their forms and arrangements, abound with suggestions of possible or probable causes determining the character of leaves and the diversities found within generic limits, and often even upon the same individual plant, according to age or size, as well as, on the other hand, the striking resemblances found among plants of widely different natural orders. The book is well calculated to awaken and foster in young people a love of nature, and to direct their attention to what is going on around them. It gives, also, an excellent idea of how many facts in the economy and ornamentation of plant-life can be rationally explained, without reference to the taste or wants of man, but solely by the 'survival of the fittest' in the struggle for existence.

— It is fortunate for those who need the valuable tables, the first instalment of which Professor Carnelly has just issued ('Melting and boiling point tables,' vol. i., London, *Harrison & sons*, 1885), that one so admirably adapted to the task should have been willing to devote eight years of almost continuous work to the compilation of a mass of material amounting to 50,000 data. The entire scheme comprises the presentation of all known data concerning the melting and boiling points of the elements, inorganic and organic compounds, and much miscellaneous information beside. The volume now before the public contains nineteen thousand data, and treats of the elements, inorganic compounds, and such organic compounds as contain not more than three elements. The second volume will include the remainder.

It is the aim of the author to state as fully as may be the constitution of every substance concerning which any thing is said, and original sources of information are indicated when known. For the convenience of readers who do not have access to large libraries, reference is also made to such related matter as may be found in Watt's 'Dictionary of chemistry,' or in the Journal of the Chemical society in London. The system of arrangement is simple, and the material accessible. The work, far more complete and convenient than any thing of its scope previously attempted, is a monument of patient industry intelligently applied.

— The wealth and thoroughness of information contained in Dr. O. Stoll's book on Guatemala (*Guatemala*, Leipzig, *Brockhaus*, 1886, 8°) shows at sight that the author is not one of the common travellers trying to perpetuate the memory of their sights in foreign countries. Stoll's main purpose in expatriating himself for five years to practise medicine in a land like that, was the thorough study of the aborigines. This enabled him to acquaint himself fully with the history, customs, and habits of the Indians, Ladinos, and whites in the western part of the country, where he resided. The results of his studies of the Indian antiquities and languages he published in a previous work, reserving for his 'Guatemala' the recital of his travels, which, from Guatemala City, extended over the east and south also, the political history, statistics, mode of life of the inhabitants, and general remarks upon the country. The numerous shortcomings and barbaric customs of the population do not excite in the writer a spirit of rancor, implacable hatred, or justifiable irony; for in most instances he simply presents to the reader, in frank and unmistakable terms, what he has seen and heard, and then leaves it to him to judge for himself. The tyrannic mode of ruling inaugurated by Barrios, the late president, forms a chapter too interesting to be skipped over.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Barometer exposure.

MR. H. HELM CLAYTON'S interesting letter on the above topic (*Science*, vol. vii. p. 484) is not quite so satisfactory as his previous communication on thermometer exposures. He seems to think that "the facts all suggest that the wind, in blowing by at right angles to the cracks and crevices in the building, produces a mechanical effect, which tends to draw the air out of the building, and decrease the pressure inside."

Until it is incontestably established by observation that such fluctuations in the height of the barometer as he cites are peculiar to indoor barographs, it seems to me quite premature to ascribe them to the rarefaction of the air within the building. It certainly would be more satisfactory to the physicist, had Mr. Clayton made comparisons of the simultaneous indications of indoor and outdoor barographs. The observed facts are, that fluctuations of wind-velocity correspond with fluctuations of air-pressure. In some cases it may be difficult to decide which is cause, and which is effect. Certainly, in ordinary cases, the alteration of air-pressure is the cause, and wind is the effect. But if, in certain cases, it can be shown that indoor barometers are differently affected from outdoor ones, there would be rational grounds for reversing the usual relation of cause and effect. If such is actually the case, it certainly is an important item in barometric records.

JOHN LECONTE.

Berkeley, Cal., June 8.

Amblystoma and Gordius.

Recently a fine specimen of Amblystoma mavortium, presented me by Professor Sedgwick, was seen to be greatly distressed in its left fore-arm. The arm was swollen to its utmost; and, holding it out at right angles to the body, the 'salamander' seemed quite unable to use either arm or fingers. Enlargement of a small pore, in a prominence near the base of the little finger, behind the carpals, disclosed the cause of the trouble in a robust hair-worm a little less than five inches in length and nearly one-twentieth of an inch in diameter. Posteriorly two-thirds of the worm's body was of a light pink or flesh color; in front of this it was darker, except about three-quarters of an inch at the head, where it was almost white. The worm was coiled among the muscles of the fore-arm, and did not appear to have wrought them any injury, the member in a few days being as useful as its fellow.

Submitted to Dr. Fewkes, the parasite was pronounced an undetermined species of Gordius.

S. GARMAN.

Mus. comp. zoöl., June 10.

Penetrating-power of arrows.

I notice in *Science* for June 11 a short letter concerning the penetrating-force of arrows.

I have made the following experiment with a Chinese bow and Japanese arrows: length of bow unstrung 5 feet 11 inches; length of string 5 feet 8 inches; length of arrow 35 inches, weight of same 2¾ ounces; height of feathers ½ of an inch, length of same 4 inches.

The bow has a strength of 110 pounds when the string is pulled back 34 inches: it is made of whalebone and bamboo cut in long strips and glued together.

At 50 yards the entire arrow passes through an inch plank of clear pine wood. At the same distance, with oak of the same thickness instead of pine, the board is penetrated by the head of the arrow, but the shaft is shattered to small pieces. With a live pigeon at 20 yards, hit anywhere, the entire arrow passes through intact.

L. O. KELLOGG.

Oswego, N.Y., June 12.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 18, 1886.

HOW TO TEACH GEOGRAPHY.

If American teachers of geography and history could know and appreciate how those subjects are taught in the best schools, and in fact generally throughout Germany, Austria, and France, they would hardly be able to recognize the fact that large and interested classes were in those countries deriving keen intellectual enjoyment, and also acquiring sound and lasting knowledge from and of two subjects which in our primary and intermediate schools are, as a rule, matters of weary memorizing and mechanical drudgery. To teach is something that most of our teachers sadly need to be taught; and of geography this is perhaps unusually true. The usual method in this country is to compel a child of from seven to twelve years to first learn an abstract definition of geography; then follow some erudite sections as to the distribution of land and water on the globe, races of men, climate, and so forth, all stated in technical language that might well appal some older persons, to say nothing of child-minds, to whom the subject is new and utterly strange. After several pages of this material have been carefully stored away in the wholly unappreciative memory, a map is introduced, and the study of geography proceeds with the learning of the names of countries, rivers, mountain-chains, towns, and other unmanageable details, all of which are treated as if they had no connection whatever with one another. In a year or two geography is 'finished,' and the process of forgetting much of it begins. This barbarous, useless, and unscientific method of teaching (it may be so called by courtesy) geography is not confined to this country: it is the method usually followed in England also: and a paper on the subject, read by R. Elliot Steel, F.R.G.S., before the College of preceptors in London, and reported at some length in the *Educational times* for May, is quite as deserving of attention here as in England. Mr. Steel summarizes the abuses and deficiencies of the present system of teaching geography under the following heads: 1°. In maps, ignorance of scale, and failure in remembering the general outlines of a country and its principal physical features, in consequence of the use of maps crammed with details, and unsuitable for teaching-purposes; 2°. More than any thing, ignorance of physical geography, including the simplest laws of the inorganic world; 3°. Total neglect of history; 4°. Ignorance of the commercial aspects of a country.

The fundamental cause of all these shortcomings is the fact that geography is not taught as a unity in any of the universities, and therefore the vast majority of the text-books are written by book-makers, and not by ardent students and teachers of the subject. Thus, the school-atlas is a clumsy, ill-constructed affair, generally designed to help adults find some obscure place or river, rather than to teach geography. The matter of scale is wholly overlooked; and the child sees no incongruity in asserting Spain to be as large as the United States, or Europe to equal Asia in size, for do not both occupy a full page of the book? This matter of scale is of primary importance, and cannot be taught abstractly. It is well to have the schoolroom supplied with a series of maps, all drawn to the same scale, say, 1 : 10,000,000. But it is far better to teach the child experimentally. Let him measure the schoolroom in units (feet and inches) perfectly definite and well understood. Then let him draw a plan of the schoolroom on the blackboard, reduced to a scale, and then compare objects with this picture. Gradually the object delineated can be changed from the schoolhouse to the block, from the block to the village or city, from the city to the state; and so on. This will fairly fix in the beginner's mind the principles of map-drawing, and after that a map will cease to represent to him merely a page of the text-book.

At present we teach words and phrases, abstractions, instead of circumstances, natural laws, and material things. For example: what possible good can be derived from making a child learn from a book that a glacier is a river of ice, which descends the slopes of high mountains, till it finally melts in warmer regions or reaches the sea? Such knowledge as this would not even fit the pupil to read profitably so popular and untechnical a book as Tyndall's 'Hours of exercise in the Alps.' Should not instruction concerning glaciers rather be given somewhat as follows? to take some snow or pounded ice, to compress it into a hard, ice-like mass, to point out how, in a similar way, after a fall of snow, the upper layers compress by their weight the lower, and how ice thus becomes formed in the cavities and gulleys

of mountains above the snow-line; then to take a piece of ice, and, by means of a wire with weights attached, to show how the ice may be slowly cut, and how it will refreeze, and thus to illustrate the passage of the glacier along its bed; to show by illustrations, preferably photographs, the nature of the moraines, the final melting of the glacier, and the formation of the resulting river. In this way the pupil's knowledge of glaciers is real and permanent, and he is prepared to read of them, and of theories about them, with appreciative interest. And in the process some elementary facts of physics and mechanics, and the simpler laws of heat, have been learned.

Again: if a child draws a map himself, and locates, say, a hundred places on it, he will probably remember them all; while not ten per cent of them, if learned from an outline-map, would be retained. The influence of geography upon history is one of the most potent of facts to the trained scholar, and, although it admits of very elementary demonstration, it is almost invariably disregarded in teaching geography. Surely it could easily be taught that there is a connection between tropical climate and despotism, between temperate climate and freedom; that vast pastures have implied a feudal society of chiefs and dependents; that aristocracy is the natural constitution of a pastoral state; that the sea and the mountains have in many instances directed the current of civilization and of political development. Books like Huxley's 'Physiography,' Geikie's 'Elementary lessons in physical geography,' and Grove's 'Class-book of school geography,' should form part of the instruction of every pupil.

Finally, the connection between geography and various phases of political and commercial life should be pointed out. It should be shown why it is that various portions of a country have various pursuits, why manufacturing, mining, agriculture, the carrying trade, respectively, are carried on in certain sections and from certain centres. From this the transition is simple and evident to the lines of trade and commerce, — whence we receive our various imported goods and why, and what we export in exchange. Then, as a means of teaching concerning peoples and products, every school should contain a museum, that the pupils might see and handle the objects of which they have read and studied. In this way, and only in this way, can the study of geography be placed upon a scientific basis, and made the vehicle of practical knowledge instead of a task in committing dry details to memory. If our teachers are to do their part in this work, they must be shown how to do it, and trained to do it. For this we must look, we hope not in vain, to our normal schools, training-classes, colleges, and universities.

THE OCCUPATIONS OF THE BRITISH PEOPLE.

THE London *Times* of May 21 has an interesting report of a paper read by Mr. Charles Booth before the Statistical society, on the occupations of the people of the United Kingdom, and on the changes that have occurred in the distribution of labor during the present century.

The *Times* says, "The inquiry is a difficult one, owing to the imperfections of the earlier returns, and the changes which have taken place in the mode of recording social phenomena. It was not until 1831 that any attempt at detailed classification of occupations was made, and even then it was of a limited and unsatisfactory kind. The next census showed some improvement; and at length, in 1851, the system was originated which still prevails, and under which the entire population is brought under enumeration and grouped into seventeen classes, with numerous sub-classes. But the system has suffered considerable modification from decade to decade since that date, and, in particular, large numbers have been transferred from one class to another; so that any thing like a trustworthy comparison of the details of successive decades becomes a matter of very great labor and difficulty. Mr. Booth has constructed tables in which these defects in the records are, as far as possible, remedied, and the figures for different periods reduced to common denominators. Some of the results will probably be found surprising by those who have not entered upon careful examination of their natural impressions."

Mr. Booth stated, that, as regarded England and Wales, between 1851 and 1881 the proportion of industrially employed women over fifteen, compared to the rest of the female population, had decreased continuously, but that the proportion of those otherwise employed — in domestic service, teaching, etc. — had increased in an equal degree year by year; so that the total employed one way or another remained practically constant. Having in a tabular form divided the whole population, taking the occupied and unoccupied together, he stated that all males over twenty were counted, for this purpose, with the occupied or self-supporting class, and the whole employed class might be divided as follows in the periods 1851, 1861, 1871, and 1881 respectively: all forms of industry (productive or distributive), 78.4, 77.2, 75.5, 74.2 per cent; public and professional service, 4.6, 5.8, 5.5, 5.6 per cent; domestic service, 13.3, 14.6, 15.8,

15.7 per cent; property-owning (so returned), 2.5, 2, 2, 2.2 per cent; and indefinite, 1.2, 0.9, 1.2, 2.3 per cent. The increase of 1 per cent in the indefinite class for 1881 was due to the transfer to this class of retired persons, who, in previous censuses, were returned under their former occupations; but, at best, those tabulated under this head were a meaningless remainder, the result of accident or defects of enumeration. Similarly the class called property-owning was entirely delusive. It contained a few land-owners, house-owners, and others who might as reasonably be included with other employers of labor in the sections of industry, and it also included a good many independent women.

It is certain that during the thirty years in question the classes whose maintenance depended on the mere possession of property must have been largely augmented. It would further be seen that public and professional service, with domestic service, had gained what productive and distributive industry had lost, and that this movement had been progressive. With regard to domestic service, it was noteworthy that the increase was mainly in the women and girls, the indoor men-servants having decreased from 74,000 in 1851, to 56,000 in 1881, while the population had risen from 18,000,000 to 26,000,000, — a fact which would seem to indicate a greater diffusion of wealth, and also, perhaps, less ostentation of expenditure among the very rich.

In public service and the professions the percentage of persons occupied in administration, law, and medicine, had slightly decreased; while police, amusement, and education had increased, education especially showing, as might be expected, a large addition in the last decade.

Coming to a detailed review of the industrial classes, he stated that the production of raw material employed a decreasing percentage. The English depend more on what they import, and less on what they find at home. The reduction, however, fell entirely on agriculture, as the percentage employed in fishing and mining had increased. For the three decades since 1851, those employed on the land had decreased at the rate of 3½, 11½, and 11 per cent respectively; being 26 per cent for the thirty years, or, stated in numbers, 60,000, 196,000, and 163,000, which added up to 419,000, an enormous total. Against these losses, which were mostly in ordinary agricultural labor, must be set the equivalent of the increased use of machinery, before we could say that less energy was devoted to the cultivation of the soil now than thirty years ago. A new class connected with the application of science to agriculture had sprung into being, and its increasing numbers pointed to a change of system, involving improvements, rather than neglect of any kind, as a cause of the decrease in the agricultural population. It seemed to be assumed by many that the reduction in the proportion of those who lived by agriculture, as compared to those who lived by other means, was not only an absolute evil, but necessarily the result of economic error of some kind, and England's land system was responsible. Such views he regarded as mistaken and misleading. His business, however, was to state the facts as given in the census returns; and these showed us, that, in the last thirty years, England had changed from a population about half agricultural and half manufacturing, to one in which manufacture was double of agriculture, and we had no reason to suppose that the process of change in this direction was yet ended. This change had been accompanied by an enormous increase in the total population, so that altogether support had been found during this period in other ways than the tilling of the soil for a new population of 8,500,000 souls. Since the beginning of the present century we had had to find new means of support for no fewer than 17,000,000 people. In calling attention to and correcting certain statements, which had been made with regard to what was called the 'depopulation' of our rural districts, — statements made, he said, to support propositions of violent social change, — Mr. Booth stated that the exodus from rural or non-urban districts amounted to 605,000 instead of 2,000,000 (mentioned by Mr. Wallace in 'Bad times' as the decrease between 1871 and 1881 in the rural population), and that the influx into the towns was less, again, than the total exodus from the rural districts by reason of the loss by emigration, finally reducing Mr. Wallace's 2,000,000 to 441,000. The greatest influx into urban areas was into comparatively new places, while the next greatest movement was that into the country districts surrounding the present centres of population, and especially adjacent to the new urban districts.

Purely agricultural districts had lost population largely, but otherwise there had been all over the country a fair distribution of the increasing millions, and everywhere new occupations had been found. It was unfortunately impossible to trace the occupations, other than agriculture, of the non-urban population. The backbone of the industrial organism they were studying was building and manufacture, which he ventured to bracket as being alike the turning of raw materials into things serviceable; and they found that this remained nearly constant, at 38 per cent of the employed population.

The industrial development of England since 1851, and her apparent position in 1881, might, on the whole, be regarded with satisfaction; nor could any changes since 1881 have seriously affected the result. The growth of the population of Scotland ($6\frac{1}{4}$, $9\frac{3}{4}$, and $11\frac{1}{2}$ per cent for the three decades) had been slower than that of England, and the proportions engaged in each main division of industry were somewhat different; but the points of similarity were much more noticeable than the points of difference.

If the picture given of the condition of agriculture in England and Scotland was gloomy, that of the whole condition of Ireland was much more so. The numbers employed in agriculture had decreased since 1841 by 858,000, out of a total of 1,844,000; and those who might, perhaps, be counted as supported by agriculture, by 2,500,000 out of 5,000,000. Nor was that all; for, these reductions being proportionately greater than those of the whole population, the percentage employed in or supported by agriculture had decreased, as well as the total numbers. The land in England and Scotland employed as many, and probably supported nearly as many, as it did in 1841; and meanwhile other productive industries supported the bulk of our great increase of population. In Ireland, on the other hand, not only did the land fail to support half of those it once in some fashion maintained, but other productive industries (e.g., building and manufacture) were even worse off, and, like agriculture, showed it both in numbers and percentage, those engaged in building and manufacture (taken together) being 10.9 less in percentage, as well as 626,000 fewer in number, than in 1841. It was when taken together that these facts appeared so serious as evidence of decadence. Nevertheless, the view was commonly held, that, in general well-being, Ireland had enormously improved since the famine. No evidence of this improvement was to be found in the occupation returns, which, on the contrary, pointed to a demoralization of industry likely to be the cause, as well as consequence, of poverty and waning trade, and certain to be the source of political discontent. He knew that figures might be, and were, drawn from bank deposits and other returns which seemed to tell a different story. He would not attempt to reconcile this conflict of evidence, as to do so would be beyond the scope of his paper.

The *Times*, continuing its comments, says, "Before drawing conclusions as to the amount of labor applied to the soil, we have to remember that much of the apparent loss is simply due to the substitution of machinery for human activity, and also that numbers of men now included in the manufacturing class are, in fact, employed, though indirectly, in extracting food from the soil. A reaping-machine supersedes a great deal of rural labor, but its construction involves the labor of a great many miners and artisans. It is perfectly proper to include these in the manufacturing classes for statistical purposes; but it would be a wanton misuse of statistics to ignore the fact, when the supply of food is in question, that it is the growth of food which provides them with employment. Mr. Ruskin asserts for himself the right to rail at all substitution of machinery for human handicraft; but practical men who accept labor-saving machines in cotton-mills cannot consistently object to their introduction into corn and beef factories, however much they may lament the tendency of 'progress' to transfer men from the open air to confined workshops. It curiously illustrates the continual failure of statistics to overtake the changes occurring in the social organism, that the distinction, apparently so sound and simple, between agricultural and manufacturing industry, utterly breaks down upon examination. There may be an actual decrease in the amount of energy applied to the production of food; but statistics do not tell us what it is, because they fail to discriminate between real withdrawal of energy from agriculture and mere change in the methods of applying it."

MRS. SIDGWICK AND THE MEDIUMS.

THE May meeting of the London society for psychical research was the occasion of the presentation of a paper by Mrs. Henry Sidgwick, which has been looked forward to with interest. The title of the paper was "Results of a personal investigation into the physical phenomena of spiritualism, with some critical remarks on the evidence for the genuineness of such phenomena." By physical phenomena of spiritualism, Mrs. Sidgwick means those which, if correctly described, and not due to conscious or unconscious trickery, nor to hallucination on the part of the observers, exhibit the action of a force in the physical world which has been previously unknown. Such physical phenomena would include raps, movement of tables without contact, materializations, psychography, and so forth. The writer stated that her experience in spiritualism extended over a period of twelve years, and had been entirely inconclusive except in cases where the phenomena were proved to be due to the action of the medium. She had had *séances* with all the leading English mediums (including Dr. Slade), and in every case there was evidence pointing more or less directly to deception and conjuring. The first part

of the paper was concluded with a description of the kinds and methods of deception practised by a medium named Haxby.

Mrs. Sidgwick then went on to discuss the various causes of error. She did not believe that hallucination, i.e., perception without objective counterpart, which Von Hartmann suggests as the explanation of what is seen at *séances* of this kind, had occurred in her own experience; but illusion, meaning the misinterpretation of what is really perceived or the confusing of inference with observation, was very common. It was believed that this was often the case when friends and relations are recognized in the 'materialized' forms.

Moreover, in estimating evidence concerning *séances*, a wide margin must be left for conjuring of a more special kind, and also for mal-observation arising from other causes, such as the ignorance of the observer as to the precise phenomena and conditions to be expected. Mrs. Sidgwick said that two arguments against the reality of the physical phenomena of spiritualism gained in force every year: 1°, the absence of phenomena about which there could be no question as to conjuring raised; and, 2°, the fact that almost every medium who had been prominently before the public had been detected in fraud. Nevertheless, the writer felt that there was some evidence not to be neglected, and which made it a duty to seek for more; but she considered it a waste of time to seek it with professional mediums under the conditions imposed at present. It is probable that many of the conditions supposed to be necessary, and which complicate the investigations and increase their difficulty, are invented merely to facilitate trickery.

Mrs. Sidgwick's paper was candid and able, and dealt with evidence, not theories. It is one more example of the good work being done by the Society for psychical research in determining just what basis there is for the multitude of current beliefs concerning certain classes of psychical and semi-psychical phenomena. In this case the conclusions are negative — or, as was remarked in the discussion of the paper, positive — as to imposture.

THE EVOLUTION OF LANGUAGE.

THE present advanced condition of our knowledge of language reflects, as well perhaps as any other study, the advantages of the modern method of research. One marked feature of that method is the taking of a broad general point of view, from which almost any pertinent fact bears an interest and a meaning: it does not narrowly and pedantically say such and such is my domain; what is outside does not concern me. The condition of logic about one hundred years ago shows what happens when the latter position is taken. A second feature of modern methods of study is the importance assigned to the evolution of things: we want to know not only how things are, but quite as well how they came to be so; only then do we say we understand them.

Both these methods have been applied to language. Language is considered from a broad biological point of view as the means of communication between the same or different animal species. Human speech is but the highest stage of a special development of one form of such a means of communication. We shall see below how it is related to more lowly forms of making one's self understood. Not only its evolution, but its devolution, its loss and impairment in disease, have been wrought out. This has led to the formulation of an important law, which tells us that the latest acquired and best organized is the first to drop out. Moreover, it has sifted out the separate moments in the acquisition of speech, by a comparison of cases in which one special function is lost, while all others remain intact. Its anatomical seat in the brain is localized with as much exactness as that of other less complex faculties. The purely philological study of language is certainly flourishing, and is making its way back into the remotest antiquity, when it seems almost to touch hands with the prehistoric man of the anthropologists.

A recent writer in *Kosmos* (Dr. Carl Francke) has presented a very readable account of the relation of human speech to that of other animals. Any thing is regarded as a language which serves as a means of communication: the system of signals (probably by use of the antennae) by which ants tell each other of a precious find is perhaps the most rudimentary type of language. When we ascend to mammals and birds, which have lungs and use them as men do, we find that the sounds thus uttered are variously affected by emotional states, and soon serve to express the presence of such emotions. The dog barks with joy, howls with pain, and pleads by whining. In this tendency of psychic states to express themselves by vocal utterances, we have the origin of speech; for they become real speech-sounds as soon as other animals appreciate their meaning. The next great step is taken when an animal utters a cry for the purpose of calling its mate, not as a half-reflex expression of its own condition. Young birds probably have not reached this stage, but dogs certainly have. A dog will bark before a closed door till some one opens it. Some animals post sentinels, which give a definite cry of

warning in case of danger. The further argument for the possession of a language-sense by mammals and birds, at least, is that they readily learn to respond to a name given them. To what extent that sense can be cultivated is shown in Sir John Lubbock's dog, which brings out a card with 'o-u-t' on it when he wants to take a walk. The close sympathy between man and the higher mammals depends upon the fact that they can mutually understand one another, can distinguish the tones of pleasure and approval from those of pain and censure. How much more difficult is it to establish a similar bond between man and a reptile, for instance! for here the scope of mutual understanding is very limited. So far, what may be called an interjectional language, that is, one composed of sounds directly expressive of accompanying emotions, has alone been spoken of. The human infant, and probably primitive man, made much use of such a language. But our present language is an intellectual, a thought language, which in some way must have been developed from the former. Before touching this rather speculative question, it will be well to consider a form of language still current, but not expressed by sounds; namely, the gesture-language. This is both the simpler and the more natural. It is possible only in animals with easily movable limbs, especially in mammals, as witness the prancing of a dog, the exposing of the canines, the purring of a cat, or pawing of a horse. The ape has a special facility in this direction, and uses its facial muscles as a means of expression. We use the gesture-language in nodding, beckoning, threatening, and so on. This language, like the spoken, is acquired by the child, but much sooner than the latter: it reaches its highest development in the less cultured tribes, while the spoken language is seen in its highest phases among the most civilized; it is more general and uniform than any spoken language, and is capable of considerable development, as is shown in the training of the deaf and dumb. All these circumstances suggest that the gesture-language is a rudimentary one, which now is on the decline, but which has had a considerable development in the past. Combining this fact with the high development of this faculty in the ape (which has almost no sound-language), we seem to be tending to the conclusion that the creature from which man developed in one direction, and the apes in another, possessed both a sound and a gesture language; that in man the gesture-language was developed at first, but was then superseded by the spoken speech, beginning probably with an interjectional vocabulary, while in the apes the gesture-language alone was developed.

A still higher stage in the evolution of human language was made when the interjectional and the gesture languages fused, and formed a sound-gesture-language. One reason for this change was that the gestures appealed to the eye, whose limit of distinct vision is very circumscribed; while speech appeals to the ear, which can hear in all directions and at great distances. This may have been prompted, too, by another reason. When desiring to communicate in the gesture-language, one would first interject a cry to call attention to that desire, and then the message would be told in pantomime. Many tribes cannot fully express their meaning without accompanying gestures, and it is told of one tribe that its members cannot communicate in the dark. But certain sounds are in direct connection with gestures. When one wants to refer to the teeth, one would point to them with the tongue; the chief function of the teeth is eating, and the interjectional cry accompanying this gesture would be modified into the word for 'eating.' Evidently, then, dentals ought to be found in the words for 'eating' in various languages. Here are a few: Gothic, *itan*; Greek, *esthiein*; Latin, *edere*; Tartar, *atarga*; Mongolian, *edeku*; Chinese, *tsidh*. Many words for 'teeth' contain these dentals: as, *dens* ('tooth'); Persian, *dendun*; and so on. The sound *l* in connection with tongue-gestures, the sound *st* in connection with words for keeping silence (i.e., sounds with the mouth as much closed as possible), and other similar cases, could be summed up. Another class of natural words, as has long been recognized, is due to imitation. We see how strong this imitative tendency is in apes, young children, and even certain species of birds. The names of animals are given by their characteristic sounds, cuckoos, etc. The buzzing of the bees, the whizzing of the wind, the murmuring brook, are other examples.

One further step must be taken to set language on its present developmental stage: the man who pictures unseen gods in woods and streams, who sees signs of their pleasure in the flight of birds or the direction of the wind, must further extend his creative imagination to form sounds that are to be connected with new things and new deeds. Here, then, would be great range for individual differences; and the beginning of the confusion that reigned at the Tower of Babel must probably be put back to the time when the interjectional and gesture languages were still in full vigor. Once started on such a course, it is not difficult to imagine that languages would multiply and become hopelessly different and strange to one another. This is the problem of the philologists.

A critic should be lenient when considering speculations of this nature. The picture is doubt-

lessly filled in with greater detail than the facts rigidly warrant, and colors and forms are restored when age has worn off almost all traces of their original appearance. Nevertheless, the suggestiveness of the general view is valuable, and, when a better interpretation of the facts comes to hand, the old one can be modified or discarded.

JOSEPH JASTROW.

DISTRIBUTION OF COLORS IN THE ANIMAL KINGDOM.

MR. L. CAMERANO has recently communicated the results of his investigations on the distribution of colors in the animal kingdom to the Academy of sciences at Turin. Colors, he says, in the frequency of their occurrence, range in the following order: brown, black, yellow, gray and white, red, green, blue, and violet, the last of which is the most rare. They are, however, variable for different groups of animal life. Among the vertebrates, black, brown, and gray are the most common; among the invertebrates, red and yellow; green occurs most frequently among the lower types — never, however, in mollusks; violet appears in all the groups; while white is distributed very irregularly, but most commonly among aquatic animals.

The colors of animals generally bear some relation to the medium or situation which they inhabit. Aquatic animals usually have the colors more uniform and less lively than do the terrestrial ones. Not seldom they exhibit a transparency, and, when of brilliant colors, they generally live among seaweed and other aquatic plants, very seldom on rocks or sandy bottom. Birds of quick and rapid flight are not generally bright-colored. Animals living in sandy or rocky places are less varied and less highly colored than those living in regions covered with vegetation. The author denies the assertion that there is a constant relation between animals and their food-habits. Carnivorous animals living among rich foliage and flowers are often brilliant and varied, while many fruit-eating species are modestly or obscurely colored. The more rich a group is in species, the more varied, in general, are its colors. Intensity of coloration is not in direct relation with the amount of light to which the animal is habitually exposed, but bears a more direct relation with the general development, being diminished by deficient nutrition or disease.

A dry climate renders colors more sombre, while a moist one makes them more lively or clearer. Altitude also exerts an influence upon colors: according to the author, in the higher regions the more brilliant forms are observed, but this view is hardly borne out by facts in the animal kingdom, though vegetation may perhaps conform to it. Species of the lower groups inhabiting islands are more often sombre in color than allied species from the continents. Different regions also modify in different ways the predominating colors. In the arctic regions, white, gray, black, and yellow predominate; in Ethiopia, yellow and brown; in India, the different shades of yellow; in the tropics, green and yellow; in Australia, sombre colors, and especially black. Throughout the animal kingdom, animals of large size are generally less varied, or more monotonous, in coloration, than smaller individuals of the same groups. In most animals the more brilliantly colored or spotted portions of the body are the most exposed ones: this is especially the case in insects.

A NEW ENGLISH DICTIONARY.

THE great English dictionary of the Philological society originated in suggestions made in 1857 by Dean (now Archbishop) Trench. Though a great mass of material was collected and many eminent men lent their aid to the undertaking, yet in consequence of the death of the first general editor, Mr. Herbert Coleridge, and other disturbing conditions, the work languished until the year 1878. At that time the directorship was assigned to Dr. Murray; and the delegates of the Clarendon press consented, under certain conditions, to bear the expense of printing and publishing the dictionary. Work was at once resumed with ardor. More than eight hundred volunteer readers undertook to collect additional quotations from specified books. In the United States the reading was in charge of Prof. F. A. March of Lafayette college, Easton, Penn., who has been indefatigable in his efforts to aid this great enterprise. In the course of three years a million additional quotations were furnished, making the total number about three million and a half, selected by about thirteen hundred readers from the works of more than five thousand authors of all periods. The general editor has been aided by a considerable number of sub-editors, and various specialists have furnished material in their respective departments. The apparatus, therefore, for the construction of this dictionary, is such as the world has never before seen. It is a combination of all the resources of the English-speaking world, conducted by the men who represent the broadest and most intelligent scientific knowledge.

The aim of the dictionary, the editor states, "is to furnish an adequate account of the meaning,

A new English dictionary on historical principles. Parts i. and ii. Ed. by JAMES A. H. MURRAY, LL.D. Oxford, *Clarendon pr.*, 1884, 1885. f°.

origin, and history of English words now in general use, or known to have been in use at any time during the last seven hundred years. It endeavors, 1°, to show with regard to each individual word, when, how, in what shape, and with what signification, it became English; what development of form or meaning it has since received; which of its uses have in course of time become obsolete, and which still survive; what new uses have since arisen, by what processes, and when: 2°, to illustrate these facts by a series of quotations ranging from the first known occurrence of the word to the latest, or down to the present day, the word being thus made to exhibit its own history and meaning: and, 3°, to treat the etymology of each word on the basis of historical fact, and in accordance with the methods and results of modern philological science." The dictionary divides words and phrases into main words, subordinate words, and combinations. Main words are all single words, radical or derivative, and those compound words and phrases which are important enough to be treated in separate articles. Subordinate words include variant and obsolete forms of main words, and such words of bad form or doubtful existence as it seems proper to record. Combinations are usually dealt with under the main words which form their first element. The treatment of a main word comprises, first the identification, that is, the proper spelling and pronunciation, the grammatical designation, and the status, together with earlier spellings and the inflections; next the morphology or history of the form, that is, the derivation or etymology, the subsequent form-history, and miscellaneous facts respecting the history of the word; then the signification or sematology, obsolete senses being distinguished from those now in use; finally the illustrative quotations, which are arranged chronologically so as to give about one for each century. The scope of the dictionary is thus the largest possible, and it may properly be termed an encyclopaedia of English forms. The total number of words treated in the dictionary under the letter *A* is 15,123; namely, 12,183 main words, 1,112 combinations and compounds, and 1,828 subordinate words and forms, with synonymes. Of the 12,183 main words, 8,184 are current, 3,449 (28½ per cent) are marked as obsolete, and only 550 (4½ per cent) as foreign or imperfectly naturalized. As the letter *A* comprises in English dictionaries about a sixteenth of the whole alphabet, the editor estimates the total number of words to be dealt with in the dictionary as upwards of 240,000: the main articles being 195,000; the subordinate articles, 28,000; and the combinations or compounds requiring separate explanation, 18,000.

The way in which the work has so far been executed is entitled to all praise. On the etymological part, the best scholarship of the day has been called in, and all available material utilized. The arrangement of the significations has been made with great care; and how complicated and difficult a matter this is, may be seen from the articles *A*, *after*, *back*, *attend*, *arise*, and many others. The pronunciation also is very carefully indicated. Throughout the book, American peculiarities are noted. Part ii. goes down to the word *batten*.

It is impossible in a brief notice even to mention the words which have curious and entertaining histories. Nobody can fail to find the reading of this dictionary a most profitable occupation. Going over its articles is like entering a new country, or like the voyage of discovery which a great landed proprietor makes through his own domains. English words take us all over the world, and bring us into connection with almost all known languages; and the science of English etymology is a very wide and difficult one. It is surprising how many words there are whose origin is still unknown, such as *andiron* and *average*. The word *abthane* shows how men's imaginations can construct entirely baseless significations. One evil side of Dr. Johnson's influence is seen in the word *ache*. The queer paths taken by Arabic words show themselves in our *admiral*.

I do not find in the dictionary mention of the forms *anywheres* and *aprioric*. The definition of the word *apocrypha* is incomplete· it should include the apocryphal writings of the New Testament times. In the etymological notices of the words *Arab*, *Aramaean*, it should be stated that these are originally from the Arabic and Aramaic languages. Under *Araby* in the illustrative quotations we miss Milton's 'Araby the blest.' There is no reference to the possible Arabic origin of the flower name *anemone* as 'wounds of Naaman or Adonis.' The historical explanation of *barmecide* is not quite correct: the family was not one of 'princes ruling at Bagdad just before Haroun-Al-Raschid,' but a Persian family who occupied the position of vezirs under the caliphs, and it is surprising that the spelling *Raschid*, this unnecessary Germanism for *Rashid*, is retained.

C. H. TOY.

MYOPIA is said, on good evidence, to be increasing with great rapidity in Europe. During the past fifteen years the proportion of near-sighted students in the Polytechnic school of France has risen from thirty to fifty per cent, and eighty per cent of the students have to wear glasses.

SCIENCE, June 25 1886.

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FRIDAY, JUNE 25, 1886.

COMMENT AND CRITICISM.

NEW HAMPSHIRE is more frequently visited by earthquakes than any other New England state; area for area, it is probably more often shaken than any other part of the United States east of the Rocky Mountains: but we have as yet very little definite information about its shocks. It is probable, from recent studies, that the area affected by a single disturbance is much larger than has been supposed. Systematic collection of records for a number of years is needed; and to this end, members of the Appalachian Mountain club have recently been urged by Mr. W. M. Davis of Cambridge to interest residents in New Hampshire, and elsewhere in New England, to report promptly any earthquake they may feel, noting its date, time (accurately), duration (in seconds), sound, and relative violence (very light, light, moderate, strong, or severe). On the receipt of such report, assistance will be given by the U. S. geological survey to trace the extent of the area affected.

SOME OF THE DIFFICULTIES of forest-culture in the British empire were well brought out at the meeting, May 4, of the select committee of the house of commons, appointed on the motion of Sir John Lubbock to take evidence upon the subject of forestry, with a view to the desirability of establishing a school of forestry. Dr. Sclieh, director-general of Indian forestry administration, in answer to Sir John Lubbock, said that there was a fair field for investing a certain amount of capital in woodland, provided the woods were planted on surplus lands, and not on lands required for agriculture. He did not believe that lands which could be made useful for agriculture would yield the same terms if put in woodland. There was a considerable quantity of waste land in that country which could be set aside for woodland without infringing upon the land required for agriculture. The establishment of a school of forestry would be most valuable, because it would disseminate better views with regard to the management of woods. The Indian government had always been most anxious to help the colonies, and had sent forestry officers to Ceylon, to the Cape, and to Cyprus; but those officers always returned to India because the colonies would not offer them proper terms. The colonies wanted to have men, and to be able to discharge them at their will and pleasure. The Indian government objected to sending away experienced men for the best portion of their working lives, and then to have them return to India in order to be pensioned off. If he were an owner of woods in England under existing conditions, he would probably send his wood bailiff for some time as an apprentice to a shrewd Scotch forester; if there was a school of forestry, he would probably send him to that. A very large quantity of land in Ireland was suitable for woodland; and practically about seven per cent of the land in Scotland was waste land.

THE NEW YORK LEGISLATURE has passed a law for the regulation and control of the practice of veterinary medicine. The law requires the registration of all practitioners, with the evidence of proper qualification afforded by a diploma from some legally incorporated college, or a certificate from an incorporated veterinary society. New York is the first and only state in the union to recognize and protect this profession, as it was the first to establish veterinary schools and to organize a state veterinary society.

IN CONNECTION WITH the article in *Science* of June 18, on a 'Final buffalo-hunt,' it is interesting to note the prospectus of the North-west buffalo-breeding company. This prospectus sets forth that Mr. S. L. Bedson, warden of the Manitoba penitentiary, a few years ago became possessed of a young buffalo-bull and four heifer calves, which have so increased that he now has a herd of eighteen bulls, twenty-five cows, and eighteen calves, all thoroughbred; that, experimenting by crossing with ordinary native cattle, he has found the half-breed possesses largely the characteristics of the thoroughbred, differing only in color, which will make the robe more valuable on account of its novelty; and, further, that, by judiciously crossing the thoroughbred bull with the half-breed cows, he has grown three quarter-

breeds, which closely resemble the buffalo, the head and robes being quite equal, if not superior. Besides the breeding of absolutely thoroughbred buffalo, it is the plan to breed "from selected native or imported Scotch cattle a half-breed that will supply the demand for a perfect buffalo-head; a robe equal in all respects, if not superior, to the best now in the market; and a beef possessing the venison-like taste and nutritious qualities of the pure stock of the plains." The three strong points of the new animal are to be his noble head, his pelt, and his flesh.

AS HAVING A BEARING on the value of the work of the U. S. fish commission, we are glad to give the following figures. The aggregate catch of shad on the Atlantic coast the present year is the largest that has been made since 1872. The Potomac River fisheries show an increase of nearly 100,000 shad over last season. The largest proportion of the catch in the Chesapeake and its tributaries is, however, made by the pound nets in salt or brackish water. The Hudson River was first stocked by the U. S. fish commission with the young of the Atlantic salmon in the spring of 1884. Well-grown sea-run fish weighing from ten to sixteen pounds are being taken at the Troy dam, and there is every reason to expect that the salmon will be permanently established in the Hudson River and its tributaries. The rainbow or California trout which was first introduced on the east coast in 1879, and which has been planted in a number of streams in Pennsylvania, Virginia, Tennessee, Alabama, and North Carolina in the last two or three years, is now being taken by anglers in various localities. Quite a number of specimens have recently been taken in the Holston River in the vicinity of Marion, Va., some of them measuring over eighteen inches in length. This stream was stocked with yearling California trout in the spring of 1884.

PETROLEUM AND NATURAL GAS AS FOUND IN OHIO.

THE introduction of natural gas into Pittsburg and other towns of western Pennsylvania within the last two years, and the marked advantages to manufacturing industries accruing therefrom, have made a great impression on surrounding districts, and especially upon Ohio.

In the last-named state an eager search for the new fuel has been entered upon, and is still going forward at a number of the industrial centres. As a result, many interesting geological facts have been brought to light, some of which have great economic importance. Additions have also been made to our knowledge of petroleum and natural gas. A few of the leading facts that have been established in this connection, and some of the conclusions that seem warranted from them, will be given here.

1. Petroleum and natural gas do not need to be considered apart: they are products of the same strata. Every gas-rock is an oil-rock as well, and all rocks that contain oil contain gas also. These products are often intimately associated in the reservoirs, appearing simultaneously when the rock is pierced by the drill; but in some cases gas only is produced.

When, however, the rock which produces so-called dry gas is followed far enough, it is always found to contain oil as well. Generally the two products are at no great remove from each other. Their separation seems referable to geological structure, as will presently be shown, the gas occupying the higher portions of the common reservoir.

2. The origin of petroleum and gas from organic matter as opposed to the so-called chemical or inorganic theories of their origin, is strongly supported by the facts here furnished. The chemical theories require temperatures high enough to leave ineffaceable marks on the strata from which the petroleum is derived; but no such marks are found in the borings of even the deepest Ohio wells, and some of these wells nearly exhaust the paleozoic scale. There are no igneous intrusions, and no disturbances whatever of the sort that accompany metamorphic action; but from top to bottom the series is normal in all respects, affected only by light dips and low folds.

It is also found that different strata in the same series contain petroleum and gas of different characters: in other words, the character of the product is definitely related to the character of the receptacle and of the strata directly associated therewith.

3. Petroleum exists as such in Ohio rocks. It is actual, and not merely potential. There is no proof that it is now forming. For any thing that appears, the stock contained in the rocks may have been formed contemporaneously with the beds that contain it. There is, it is true, in addition to this petroleum content, a considerable percentage of organic matter in some formations, as in the black shale, which can be converted into gas and oil by destructive distillation, and, so far as we know, by this process alone; but, as shown in the preceding section, there is nothing whatever to lead us to believe that the process of destructive dis-

tillation has ever been applied, least of all that it is being applied, to Ohio rocks. The claim is sometimes made for an agency of manufacture called 'spontaneous distillation;' but, so far as can be seen, this is a human invention, and not a natural process. Instead of furnishing an explanation, it begs the question at issue. Destructive distillation we know, and chemical decomposition, in its various phases, we know; but what is 'spontaneous distillation' as an agency for the formation of petroleum from organic matter?

4. The wide diffusion of petroleum and its derivatives is well illustrated by the facts recently developed in Ohio. It is a mistaken view that these substances are of rare occurrence. Valuable accumulations, of course, are rare, but their presence in measurable quantity is well-nigh universal in the paleozoic rocks of the Mississippi valley. Prof. N. W. Lord, chemist of the Ohio geological survey, has recently examined the black shale of the state with this reference. He finds in normal shale more than two-tenths of one per cent of heavy oil. This amount he has weighed, but, from the nature of the processes he was obliged to use, he is certain that he has not obtained all that was present in the shale. Petroleum as such, or compounds derived from petroleum, as asphaltic grains or films, are also found in all of our principal limestones. Dr. Hunt reported, a number of years ago, more than four per cent of petroleum, or bituminous matter which was undoubtedly derived from petroleum, in the Niagara limestone of Bridgeport, near Chicago. These figures can be duplicated in some phases of the upper Silurian limestones of Ohio.

5. The amount of petroleum stored in the rocks is seen to be enormous. Take the figures of Professor Lord, already quoted. Two-tenths of one per cent of petroleum in a rock represents more than twenty thousand barrels to the square mile for every foot in depth. But the black shale is on its outcrop three hundred feet in thickness, and in the interior the formation is from four to six times as thick. Three hundred feet of shale would contain, to the square mile, six million barrels of petroleum. Suppose the rate given above is too high: divide it by two, by four, by eight, and even the last result would show nearly as much petroleum as has ever been taken from any square mile of the Pennsylvania fields.

6. The old dispute as to whether petroleum is mainly derived from bituminous shales or bituminous limestones has become 'a past issue,' largely through recent developments in Ohio. No question relating to the geology of petroleum has been more warmly or ably discussed. As so often happens, both sides were right in their main affirmations, and both were wrong in what they denied. The petroleum and gas of eastern Ohio, and, by the same token, of western Pennsylvania and New York, are unquestionably derived from the great shale formation of Devonian and subcarboniferous age that underlies this territory, and they are stored in sandstones overlying or interstratified with these shales. The petroleum and gas of north-western Ohio are as certainly derived from good normal Trenton limestone that is at least five hundred feet thick, and underneath which no shales are known to exist.

That the oil and gas of eastern Ohio are derived from the shales, and not from the sandstones in which they are now found, becomes evident from the fact already noted; viz., that the underlying shales always contain a measurable amount of petroleum, while the Berea grit, which is the main Ohio reservoir, is everywhere, in outcrop and under deepest cover, a clean, sharp sandstone, remarkably free from organic remains of all description. *Ex nihilo, nihil fit.* If the source of oil were to be found in a sandstone containing organic remains, the Logan conglomerate (Pocono) should be a much more productive rock than the Berea grit. It is ten times as thick, and several times as coarse, and contains a profusion of sandstone casts of tree-trunks; but it is underlain with light-colored instead of black shale. It is the great salt-water sand of eastern Ohio, and is but rarely petroliferous on any considerable scale.

7. The gas and oil derived from bituminous shales are found to differ in composition, to some extent, from limestone oil and gas. In particular, the latter are never free from small percentages of sulphur compounds, none of which appear in the gas or oil of the shale. These compounds advertise themselves wherever they occur, and make the most noticeable characteristic of these oils.

The composition of Pittsburg gas is reported as very variable, even from the same well. All the observations on the limestone gas of Ohio show it to be remarkably steady and uniform.

Mr. S. A. Ford, chemist of the Edgar Thompson steel-works, gives a number of important facts concerning the composition of Pennsylvania gas in a recent number of the *American manufacturer* (Natural gas supplement, April, 1886). He gives the composition of what he counts average Pittsburg gas, as follows: —

Pittsburg gas.

Hydrogen	22.00
Marsh-gas	67.00
Ethylic hydride	5.00
Olefiant gas	1.00
Nitrogen	3.00
Carbonic acid	0.60
Carbonic oxide	0.60
Oxygen	0.80

The composition of the limestone gas of north-western Ohio (Findlay gas) is quite different, as appears from the following analysis made by Prof. C. C. Howard of Columbus, for the Ohio survey : —

Findlay gas.

Hydrogen	2.18
Marsh-gas	92.60
Olefiant gas	0.31
Nitrogen	3.61
Carbonic acid	0.50
Carbonic oxide	0.26
Oxygen	0.34
Hydrogen sulphide	0.20

There are 125.8 grains of sulphur in 100 cubic feet of this gas.

Analyses made a year apart show that the constitution of the gas has remained practically unchanged during this interval.

The reference of the gas or oil of shales to limestones, or of the gas or oil of limestones to shales, is seen, in the light of these facts, to be inadmissible. The two series are distinct. These facts also furnish an additional argument against the chemical theory of origin of the petroleum series. Such an origin would seem to insure identity of composition to at least the oils of a single district.

8. Gas and oil are accumulated in more or less porous rocks that act as reservoirs. These reservoirs may be continuous with the source, or they may be distinct. In the case of limestone oil and gas, the first of these conditions is found. The stocks that are held in sandstones come under the second head.

While there are many horizons of gas and oil in Ohio rocks, covering the three main elements of the series, — viz., sandstone, limestone, and shale, — there are two of paramount importance; viz., the Trenton limestone and the Berea grit. The Trenton limestone nowhere rises to the surface in Ohio. It was first discovered to be a storehouse of high-pressure gas at Findlay in November, 1884. It is now yielding both gas and oil in large amount in at least three counties of northern Ohio, — viz., Hancock, Allen, and Wood, — and it promises to become by far the most important source of these products in the state. The section by which it is reached in the productive districts is as follows : —

200′–400′	*Limestone*, upper Silurian	Waterlime. Niagara. Clinton.
800′–1000′	*Shale*, mainly lower Silurian	Medina. Hudson River. Utica.
500′	*Trenton limestone*	Gas and oil accumulated in uppermost beds, often at upper boundary, and never more than 40 feet below.

The main production of this new horizon has, so far, been limited to points where its upper boundary ranges between three hundred and five hundred feet below sea-level. It has been reached in at least a hundred drill-holes within the last year, through a district which would include from eight thousand to ten thousand square miles. The composition is shown by the following analyses of the gas-rock of Findlay and the oil-rock of Lima, which are one and the same thing.

	Findlay.	Lima.
Carbonate of lime	47.05	52.66
Carbonate of magnesia	38.88	37.53
Residue, mainly silliceous	11.73	4.15

The rock is highly crystalline and porous, and the greatest porosity seems to belong to the most productive portions.

The Berea grit becomes petroliferous from the moment that it takes cover. The oil of Mecca and of Grafton is derived almost from the outcrop of the rock. In the first instance, indeed, it has only the bowlder clay for a roof; and, in the second, there are but from forty to sixty feet of Berea and Cuyahoga shale above it. It is only where it descends deeper, however, that it holds large stocks of gas or oil. The lightest cover under which large accumulation has been found in Ohio is six hundred feet, while in the Macksburg field, which is at present the main centre of production from this horizon, the stratum is at least twelve hundred feet below the valley level. The section found here is approximately as follows : —

Coal-measure strata	500′–800′
Conglomerate measures	200′–300′
Logan conglomerate (salt-water sand)	200′
Cuyahoga shale	300′
Berea shale	30′–50′
Berea grit	5′–25′

There are two distinct oil-sands in the coal-measures, and one in the conglomerate group in this section, in addition to the Berea.

These reservoirs, whether sandstone or limestone, are permeable, and often communicate freely through considerable space. The gas-wells of Findlay are quite unequal in production, ranging between one hundred thousand and twelve million cubic feet per day; but when shut in, all show the same pressure. This pressure is now a little less than four hundred pounds to the square inch. It is called the rock-pressure. A large well, when shut in, comes up to this point quickly, and a small well slowly, but all get to the

same point. The flow of the well seems to depend on the porosity of its immediate reservoir. Free communication is also shown in adjacent portions of the Berea grit, but there is nothing to indicate an indefinite or universal permeability. The changes in the grain and thickness of the stratum would naturally divide it into basins approximately distinct from each other.

9. Every oil-rock has a more or less impervious cover, generally fine-grained shale. To constitute an oil-group, three elements are essential; viz., a source, a reservoir, and a cover. The first and second may coalesce, as has been already shown, but the third must be distinct and well-characterized. First in order of importance, as a matter of course, is the source, but so generally is petroleum distributed through the rocks of our scale, that its presence may almost be taken for granted. Practically, the character of the overlying mass is a chief factor. Almost any rock of the Ohio series, if covered by a heavy mass of shale, shows oil or gas when reached by the drill. The Utica, Hudson River, and Medina shales cover the oil-bearing Trenton limestone: the Berea and Cuyahoga shales overlie the petroliferous Berea grit. The corniferous limestone, which is covered by the heavy deposit of the Ohio shale, ought by this order to be also a source of oil. It has been found to be so in Canada, but not yet in Ohio.

10. One other factor is found to be of prime importance in oil and gas production; viz., geological structure. Source, reservoir, and cover may each be complete in itself, and yet no accumulation of either product may result. Illustrations are found in both of the main Ohio horizons.

For many thousand square miles, the relations of the several elements of the series that has proved petroliferous in north-western Ohio are absolutely identical. A hundred wells have now been drilled in this field, and the records of the series traversed are monotonous repetitions of one another. From one you can learn all. Not only is there the same order, the same thickness, the same color, but there is substantially the same chemical constitution of each stratum throughout its entire extent. In all cases there is some accumulation of gas and oil, but generally slight, at the top of the Trenton limestone.

But at one point, as the drill has now shown, in a drift-covered plain, where all the facts were hopelessly obscured to other reading, the steepest dip known in Ohio rocks has been brought to light. Two terraces of Trenton limestone, with their superincumbent strata, are made known to us, one of which is about 310 feet (306, 312, 314) below tide, and the other of which is about 475 feet below. The slope of 165 feet that connects them occupies a little more than a half-mile in breadth. What effect does this marked structural feature seem to have on oil or gas accumulation? On the upper terrace, every well that has been drilled has found a fair supply of gas without oil. The wells of the lower terrace are all oil-wells, though containing considerable gas also. And what of the wells on the slope? That depends on what part of the slope they occupy. On the upper edge, from 330 feet below tide to 350 below, there is a belt of the most remarkable and valuable gas-wells ever struck in the state. The famous Karg well produces, by the lowest measurement, 12,000,000 cubic feet per day. The Trenton limestone was found in it 347 feet below tide. In the next well in order of production, the surface of the limestone was 350 feet, and in the third well 330 feet, below the sea.

Seven wells have been drilled on the slope in which the limestone is between 330 and 350 feet below tide. One of the number is a small producer, but the smallest of the six remaining wells yields more than 1,000,000 cubic feet of gas per day.

Descending the slope still farther, we come to a group of three wells, in which the Trenton limestone lies respectively 394, 403, and 405 feet below tide. All of them were vigorous gas-wells when first drilled, but they also yielded more or less oil from the first. Little by little, however, their character has been changed, oil and salt water overpowering the gas, until now almost their sole value is found in the oil that they produce.

The facts above given come from the Findlay field. Similar facts are found at other centres of production of Trenton oil and gas.

Equally satisfactory testimony as to the all-important influence of structure on gas and oil production is supplied by the facts of the Berea grit. This remarkable stratum, the first persistent sandstone to be reached in ascending the geological scale of the state, has a bold outcrop from the Ohio valley to Lake Erie, and thence eastwards toward Pennsylvania. Scores of quarries are located along this outcrop, from which is derived some of the most valuable building-stone of the country. The stratum dips gently down from its outcrops at the rate of from fifteen to thirty feet to the mile. It holds its continuity underneath the whole of eastern Ohio. Its area in this state, therefore, is not less than twenty thousand square miles. Slight rolls traverse it, breaking up the monotony of its descent. These rolls, or interruptions of dip, connect themselves at once with gas and oil accumulation. A single example, and the one most carefully worked out, must suffice.

In the vicinity of Macksburg, north of Marietta, the light south-eastward dip of the strata is found to be interrupted, and for nearly a mile a terrace-like structure prevails. This is masked, it is true, by the immense erosion which the country has suffered, and only comes into view when the best-known elements of the exposed section as coal-seams are followed by means of the level. All of the strata ever reached by the drill, as well as all that are above the surface, are equally affected by this structural irregularity.

But this terrace is an oil-field, and has been for twenty years. Oil was first found here in shallow wells, from two hundred to three hundred feet deep in the upper Mahoning sandstone. But adventurous drillers, one after another, struck new sources of oil. A second oil-sand, and a third, were discovered at five hundred and seven hundred feet respectively. Finally the drill was sunk deeper still, until, at thirteen hundred feet, the Berea grit was found, holding a stock of oil large enough to make the Macksburg field for the first time a factor in the general market. It has produced as many as three thousand barrels per day since then, and is now yielding twenty-five hundred barrels per day.

But the shallow and the deep productive wells are alike definitely limited to the terrace that has been described. In other words, four oil-sandstones become productive in the same area when the structure is found favorable. That they do not communicate with each other is evident from the fact that the oils which they severally contain differ from each other in gravity, in color, and in chemical constitution.

The depth of the Berea grit below sea-level in the terrace is 735 feet. Of twenty-four wells, occupying four square miles in this field, sixteen reach the Berea between 733 and 737 feet, and six are found by their records to be exactly 735 feet.

On the north-western margin of the terrace, at elevations of 728, 720, 713, and 704 feet, gas is found, but no oil. After many hundred wells have been drilled on all sides, the terrace which has been revealed by the engineer's level is alone found productive.

The grain of the sandstone is in every way as promising, and its thickness as great, outside of the field as within it; and the sections both above and a thousand feet below the Berea grit appear identical in productive and in barren territory alike. It is hard to resist the conclusion that the Macksburg oil-field is dependent upon the structural irregularity here described, the other elements, of course, being presupposed.

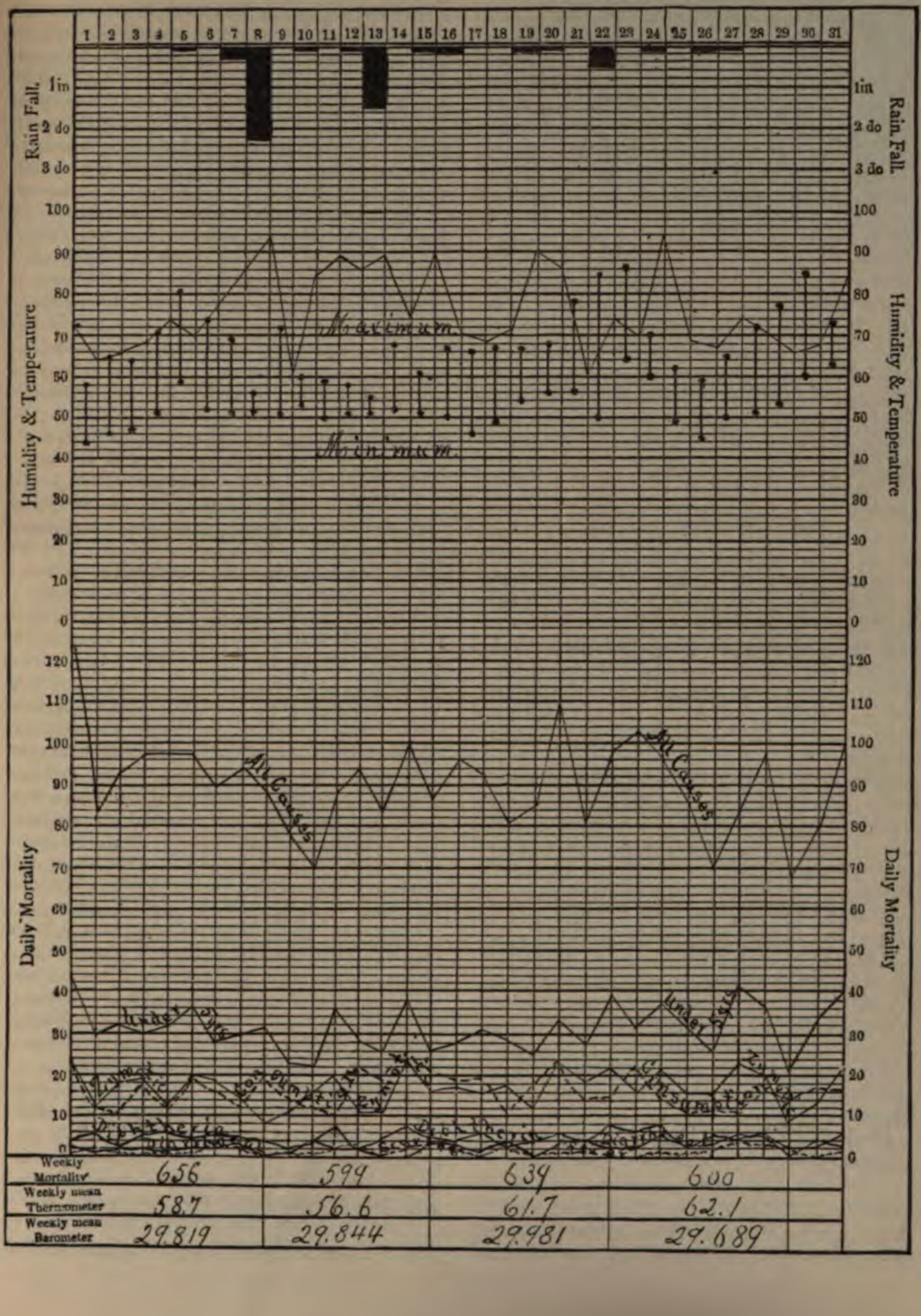
May not a like explanation be applied to the oil and gas fields of Pennsylvania and New York as well? Is it not possible that their productive areas are also dependent on structural disturbance, slight though it may be? These areas have been sometimes explained as resulting mainly from the coarseness of grain of the oil-sands. Lenticular deposits of gravel have been suggested, arranged in north-east and south-west lines for the several petroliferous horizons. It is hard to see how any one of these long tongues of gravel could be accounted for, laid down so far from the shore of the sea in which it was deposited. It is much harder to understand how, as the geological ages went by, one after another of these peculiar deposits should be laid down on these self-same lines. It is certainly much easier to conceive of the oil-sands as wide-spread sheets of sand and gravel, that become the reservoirs of oil and gas when lifted into elementary folds. This is certainly true of the Berea grit in Ohio, and this great stratum, it is now definitely settled, constitutes one of the main oil-sands of Pennsylvania. Under this view, the arrangement of the several oil-fields in north-east and south-west lines becomes easily intelligible. These oil-fields are simply conforming to, as they are determined by, the main structure-lines of western Pennsylvania.

EDWARD ORTON.

THE HEALTH OF NEW YORK DURING MAY.

THE population of the city of New York on May 1 was estimated at 1,432,094. Assuming the normal increase to be 799 each week, there would be, June 1, a population of about 1,435,290. Of this number, 2,759 died during the month of May, a mortality less by 206 than occurred during the preceding month. Of children under five years of age, there was a saving of 110 lives as compared with April. The greatest mortality from all causes which occurred during any one day was on the 20th, when 107 persons died. Of this number, 24 were children under one year of age, 29 under two years, and 34 under five years. Consumption caused more deaths on that day, as indeed it usually does on most days of the year, than any other single disease, its victims being 24. The deaths during the month from diarrhoeal diseases were 73, an increase of 16 over the month of April. Diphtheria also caused a considerable increase, its deaths being 165 against 124. Scarlet-fever maintained the same position among the mortality-factors which it had occupied for the two preceding months: the deaths from this disease in March were 42; in April, 49; and in May, 44.

It will be remembered that while rain fell on


Rain Fall.
Humidity & Temperature
Daily Mortality
Maximum.
Minimum.
All Causes
Under 5 yrs
Zymotic
Consumption
Diphtheria
Weekly Mortality
656
599
639
600
Weekly mean Thermometer
58.7
56.6
61.7
62.1
Weekly mean Barometer
29.819
29.844
29.981
29.689

but few days in the month of April, only seven, yet the aggregate rainfall was about the average for the same month in preceding years. May was in all respects a month of showers: on fourteen of its days rain fell to a greater or less amount; and the total for the month was 5.40 inches. During the same month in 1885, although some rain fell on thirteen days of the thirty-one, but one less day than this year, yet the total rainfall for the month was but 1.86 inches. As will be seen by the chart, the greater part of the rain this year fell on the 8th and 13th insts. An examination of the records for the past seventeen years fails to show such a rainfall during May, the nearest approach being in the year 1882, when 4.20 inches fell. If, however, we continue our search still further back, we shall find a number of years in which this rainfall is surpassed, and in one year, 1846, nearly doubled, it being then 10.25 inches. The highest point reached by the thermometer was 86° F., on the 23d inst., at 5 P.M. On the preceding day the mercury rose to 84° F. at 4 P.M., and on the 30th it reached 85° F. at the same hour of the day.

A NEW EXPEDITION TO ALASKA.

THE New York *Times* has sent an exploring expedition to Alaska, the object of which is to explore the St. Elias range of mountains and the country between them and the sea, while an attempt will be made to ascend Mount St. Elias itself. The expedition is led by Lieut. Frederick Schwatka, who has already won deserved renown in arctic travel and research. In 1879 he led an expedition over the route of Sir John Franklin's party, and brought to the world its fullest and final knowledge of the fate of the Erebus and Terror. Again, in 1883, he explored from its source to its mouth Alaska's great river, the Yukon. It was in returning from this trip that Lieutenant Schwatka conceived the desire to visit the mountainous and forbidding southern coast of Alaska, and tell the world something of its Indian races, of its forests, its soil, and its glaciers. The *Times* has given him an opportunity to undertake this voyage of discovery and description, and it hopes in due time to lay before the public such additions to the world's present slight knowledge of this region as will amply justify the effort and the expense involved.

Lieutenant Schwatka himself has an article in a recent number of the *Times*, in which he says: —

"The New York *Times* Alaskan exploring expedition, which sailed on the Alaskan steamer Ancon from Port Townsend, Washington Territory, June 14, has for its object the exploration of the almost wholly unknown St. Elias Alps, stretching for nearly 300 miles from the upper part of that picturesque lane of water called 'the inland passage to Alaska' to Mount St. Elias, the highest peak of the North American continent, and which throws its name over the whole range, and even beyond. The expedition, therefore, will have to do with mountain-climbing; and should opportunity present, which is very likely, attempts will be made to ascend, in whole or in part, some of the numerous peaks that project from that high range. Although, strictly speaking, this is not its main object, still it would be considered no small victory to crown the king of the American continent, Mount St. Elias, with shoe-leather of American make, and, but a little way behind this, to reach the summits of any of the others, — Crillon, Fairweather, La Perouse, Vancouver, Lituya, d'Agelet, — all higher than any peak short of the Rocky Mountain range. Should the top of the main range be gained, at 8,000 to 10,000 feet above sea-level, it is hoped — and the probabilities are great — that a bird's-eye view in the interior will compensate for all the trouble taken, and especially if this be done at several points along the main ridge. Bad weather, of course, could defeat much of this part of the plan, but during the summer months this is not very likely. The interior slopes may be descended if the prospect is at all flattering for important research and discovery of any kind; for toward the interior absolutely nothing is known of the country. Prof. William Libbey, jun., professor of physical geography in Princeton college, will have charge of the scientific work, and especially the hypsometrical and topographical part of it. He has been identified with considerable practical Alpine work in the past, both in our own and other countries. The well known hypsometrical and other scientific tables compiled by the late celebrated Professor Guyot (to whose chair at Princeton Professor Libbey succeeded on the former's death), and published by the Smithsonian institution at Washington, were recently revised under Professor Libbey's care, and brought up to the requirements of scientific advancement in that line since Professor Guyot's death. Many of the hypsometrical and other scientific instruments taken were once those of that celebrated geographer."

Of the scientific aims and prospects of the expedition, Lieutenant Schwatka writes as follows: —

"The glacier system of the Mount St. Elias Alps is undoubtedly the most extensive south of the arctic regions themselves. Just how extended it is cannot be told until further exploration gives more data. It will probably be many years before

it is well outlined, as no one exploration could encompass the whole of it. One bay alone has some six or seven glaciers coming down from the southern spurs of these Alaskan Alps just off the summits of Mounts Fairweather and Crillon, which, dipping into the sea, snap off into icebergs that float away nearly as high as the masts of the excursion steamers that visit this bay — called Glacier Bay — monthly during the spring and summer. From Glacier Bay northward to beyond Icy Bay (just seaward from Mount St. Elias) there can be seen these huge rivers of solid ice coming down to the sea; one, Le Grand Plateau, so named by La Perouse, its discoverer, being probably the largest one of the immense group covering so wide a territory. It is quite evident, if the expedition accomplishes any thing, that no small share of it will be in this particular field of research.

"Between the St. Elias Alps and the sea — the Pacific Ocean — is a narrow strip of flat lands where the Indians live, and which, from the ocean, seems to be heavily wooded. It is proposed to find out the status of this timber and that on the foothills of the Alps, as far as it is possible without spending too much time upon it. If fine forests of merchantable timber are found, which is not at all unlikely, it is known that there are good harbors here which will make it quite accessible, and give value to the discovery. If any thing near as valuable as the present yellow cedar forests of the shores of the inland passage of Alaska can be found, the expedition will be a double success from this very fact.

"In the way of precious minerals there is the usual prospect of seeing them; and while the search for them is probably the last on the list of undertakings, if at all, the party will not go by any mountains of gold or silver without at least taking a photograph of them.

"It is hardly to be hoped that the country is much richer in furs than the general average of the Alaska mainland; but, should it fortunately prove otherwise, the public shall know of it in due time.

"Agriculturally there is little to be expected in such a rough Alpine country; but if the low flats known to exist along the coast are not too marshy, and have fertile soil, there is nothing to prevent their being cultivated to the fullest extent, in which case it would be doubly valuable by there being no other agricultural lands near by.

"Of the Indians living here, but very little is known; and this very fact is somewhat in favor of the expedition, as among these little known savages there is every reason to suppose that a rich ethnological collection can be made, which will not only shed some light on the people themselves, but on adjoining tribes that are somewhat spoiled for ethnological purposes by long contact with white men and civilization."

The exploring party is well supplied with arms and ammunition, as well as with food; and the precise course to be pursued by them is left largely to the discretion of the commander. When the expedition will return depends largely on its success; for Lieutenant Schwatka is determined not to return until he has accomplished something worthy of the expenditure of time and money. He hopes, however, to be back to the Alaskan coast by September of the present year.

ASTRONOMICAL NOTES.

The large dome for the Lick observatory. — At the meeting of the Royal astronomical society on May 14, Mr. Grubb, the well-known Dublin instrument-maker, presented a model of an equatorial mounting and dome which he had designed, at the request of the Lick trustees, for their 36-inch objective. The main idea throughout was to bring under the direct control of the observer all the required motions of the instrument and of the dome, so as to give him as little physical exertion as possible. To effect this the motive power was to be a number of small water-engines, controlled by an electrical apparatus which the observer could carry about with him. A tap on one key will turn the dome in one direction; another will reverse the dome; a third key will control the telescope in right ascension, and another in declination; and so on; while there is one for lighting up the observatory; and lastly, in order that the observer shall have as little difficulty as possible in getting into a position to observe, instead of climbing into a chair which would perhaps require to be twenty-five feet high, a key is provided which will make the whole floor move up or down. During the discussion upon this ingenious device, Mr. Common quoted the following paragraph from Professor Holden in regard to the prospects of completing the observatory: "We hope during the early part of 1887 that we may see the objective, both photographically and visually, completely finished, and perhaps delivered in California. Our large dome will undoubtedly be finished during the current year; and we look forward to commencing serious work with the whole observatory during the year 1887, and possibly sooner." The contracts for the mounting and dome, if any have yet been made by the Lick trustees, are not yet public.

Change of latitude. — Miss Alice Lamb, assistant astronomer at the Washburn observatory, has, in the June number of the *Sidereal messenger*, given

the results of a critical examination of the latitude observations made by army engineer officers at Willets Point during the year 1885. These observations are of peculiar interest from their bearing upon the mooted question of the variability of terrestrial latitudes; but it appears that the sequence of the results from 1880 to 1884, which seemed to indicate a gradual decrease of latitude, is interrupted by the result for 1885, which is practically the same as that for 1881. The conclusion which Miss Lamb reached from a similar discussion of previous observations (*Science*, vi. p. 118) is now further confirmed. The evidence seems to be rather against a systematic change of latitude at Willets Point, though the results for future years will be awaited with interest.

Astronomical activity. — In looking over the reports of observatories for the year 1885, one cannot but be impressed with the increase of activity in all branches of observational astronomy. Greenwich has ordered a 28-inch refractor for spectroscopic work; Struve at Pulkowa, with the new 30-inch, can go deeper than ever into the star depths for faint 'doubles;' the Vienna 27-inch, in the hands of Dr. Vogel, has already done good work in astronomical physics; and Paris has taken the front rank in stellar photography. The interesting report of Admiral Moucher, the director of the Paris observatory, now before us, gives especial prominence to this comparatively new method of research. A reproduction of a photograph of the Pleiades, taken by the Henry Brothers with an exposure of one hour, has suggested a comparison with Wolf's well-known chart of that group, upon which he spent three years' labor, and the advantage of photography in certain directions is strongly brought out. Wolf's chart contains 671 stars, the limit being the 13th magnitude; while the photograph shows no less than 1,421, the faintest being of about the 16th magnitude. In the meridian service over sixteen thousand observations have been made by sixteen different observers; the instrument devised by M. Loewy, the *equatorial coudé*, has been brought into regular use for observations of comets and minor planets; and the time service, meteorological department, etc., are all in a most satisfactory condition. A department of the observatory which we should like to see imitated in this country is the 'Ecole d'astronomie,' in which courses of instruction are given by such members of the observatory staff as Loewy, Tisserand, Gaillot, and Perigaud. The students are given employment in the computing bureau, and, after sufficient instruction, they take part in the observations with the meridian instruments. The schools of astronomy in this country are not very thriving adjuncts of our colleges.

NOTES AND NEWS.

THE following appropriations are recommended by the committee on appropriations for the various scientific departments of the government for the fiscal year ending June 30, 1887: — coast survey, \$407,246, being \$146,250 less than was appropriated the past year; the number of field officers is reduced from 64 to 48; office force, from 103 to 91: geological survey, \$467,700, the same amount as was appropriated last year: signal service, \$799,493, being \$64,587 less than was appropriated last year: national museum, \$157,500, \$19,000 more than was appropriated last year: Smithsonian institution — international exchange, \$10,000; North American ethnology, \$40,000; being the same amounts as were appropriated last year: fish commission, \$220,040, being \$40 more than was appropriated last year.

— The final excursion of the geological class of the Academy of natural sciences of Philadelphia, extending over a period of about ten days, and beginning with the first week in July, will be directed to Nantucket and Martha's Vineyard. It is proposed to investigate the physical (geological and paleontological) features of the islands, and the recent fauna of the coast. The total expense, including the academy admission-fee of seven dollars, will not exceed thirty-five dollars.

— About twenty-five thousand deaths from typhoid-fever occur in this country annually, says the *Medical record*, and this represents fully one hundred and fifty thousand cases of the disease. Statistics show that there is no disease so easily preventable as this; and it is safe to say that fully one-half of this mortality might be saved by greater cleanliness and more attention to sewage.

— A new monthly magazine devoted to the now popular art of photography has just appeared in England under the appropriate title of the *Camera*. Mr. R. A. Proctor supplies an interesting paper on photography and astronomy, with illustrations of some of the recent results of observations; Dr. Lindsay Johnson and Mr. T. C. Hepworth also contribute useful articles; and a descriptive account of the amateur photographic exhibition in Bond Street, with reproductions of some of the principal examples, is carefully written.

— Letters from Colonel Lockhart's mission, dated May 9, have reached India. The party were then near Gumbaz, on the northern slopes of the Hindoo-Koosh. They had gone northward from Gilghit, through Hunza, and would work along the Hindoo-Koosh, and enter Kafristan from the north.

— Dr. Julius Stöckhardt, the well-known agri-

cultural chemist, died at Tharandt, in Saxony, on the 1st of June, in his seventy-seventh year.

— The *Athenaeum* of June 12 states that arrangements are being made for holding an international congress for discussing papers upon climatology, mineral and thermal springs, and allied subjects at Biarritz, under the presidency of Dr. Durand Fardel, the first week in October, to be followed by a three-weeks' tour to the principal watering-places of southern France.

— The *Athenaeum* chronicles the appearance of a new Italian journal of zoölogy, entitled *Bolletino dei musei di zoologia ed anatomia comparata della R università di Torino.* At Jena an *Anatomischer anzeiger*, under the editorship of Prof. K. Bardeleben, is announced to begin its existence this month.

— The following is a list of the publications of the geological survey now in the hands of the public printer: — Sixth annual report of the director: Monographs — Lamellibranchiata of New Jersey, by Whitfield; Dinocerata, by Marsh; Geologic history of Lake Lahontan, by Russell; Geology and mining industry of Leadville, by Emmons; Geology of the Eureka district, by Hague; Lake Bonneville, by Gilbert; Stegosauria, by Marsh: Bulletins — Work done in the division of chemistry and physics, 1884–85, by Clarke; Gabbros and associated hornblende rocks, by George H. Williams; Fresh-water invertebrates of N. A. Jurassic, by C. A. White; Cambrian faunas of N. A., by Walcott; Fossil insects, by Scudder; Mineral springs of the United States, by Peale; Geology of northern California, by Diller: Relation of the Laramie molluscan fauna to succeeding fresh-water eocene, by White; Physical properties of carburets, by Barus and Strouhal; Subsidence of small particles of insoluble solid in liquid, by Barus: A geologic map of the United States.

— Howard Ayers has been appointed as an instructor in zoölogy at Harvard college.

— Under the patronage of the Grand Duke of Baden, and with the concurrence of the grand ducal government, the Industrial society of Karlsruhe, says the Journal of the Society of arts, has organized an international exhibition of the manual arts and domestic economy, to remain open from Aug. 15 to Sept. 15, 1886. The principal object of the exhibition is to make known the best *matériel* and apparatus suitable for small industries, and to popularize their use; so that all small motors, tools, and machine tools will be welcomed.

— An important exhibition of apparatus and implements for the prevention of the diseases of the vine, and for destroying insects that infest it, says the Journal of the Society of arts, was held last month at Conegliano. The exhibiters, who were not limited to Italians, were 197 in number; and of the 524 different machines, apparatus, and implements shown, 450 were connected with application of milk of lime, the most effectual remedy for the disease called peronospora, the proportion being from 8 to 10 of slaked lime to 100 of water. The experiments, made before a jury composed of the most eminent viticulturists and scientific men, which lasted five days, will be described in a report to the minister of agriculture, and will contain a variety of useful information and plates. Three gold medals, three silver with money prize of 150 francs, seven silver ones, and four bronze ones, were awarded, and, besides these, three special premiums were given by the local agricultural committee.

— The following changes have been made in the coast survey service since our last issue: Assistant Gresham Bradford has been ordered to Sandy Hook to make an examination for the location of a permanent self-registering tide-gauge; Lieut. F. S. Carter has been ordered to Baltimore to relieve Lieut. G. H. Peters of the command of the Arago, which has been ordered to New York; Ensign A. W. Dodd has been detached from the schooner Bache, and ordered to the Drift; Assistant J. B. Weir has been ordered to duty at the home office. The following parties engaged in state work have been recalled, owing to the failure, on the part of congress, to appropriate money for the continuance of this field-work: Prof. H. L. Barnard, Chambersburg, Penn.; Prof. A. H. Buchanan, Lebanon, Tenn.; Prof. J. E. Davies, Madison, Wis.; L. A. Bowser, New Brunswick, N. J.; Assistants E. F. Dickins and J. S. Lawson, Anaheim, Cal.; J. L. Campbell, Crawfordsville, Ind.; Prof. Mansfield Merriman, Bethlehem, Penn.

— The following charts will shortly be issued by the coast survey: Cape Flattery to Dixon's Entrance, and from latter point to Cape St. Elias; Head Harbor Island to Petit Manan, coast of Maine; Icy Bay to Semidi Islands, Alaska; topographical sheets of New York and Jersey City water-front from Battery to 68th Street, North River.

— Mr. A. Schuster has recently published (*Phil. mag.*, April, 1886) an analysis of certain observations on the daily variations in earth-magnetism which indicate definitely that the cause of the disturbances lies wholly without the earth.

— According to Professor Heim, says *Ciel et terre*, the total number of glaciers in the Alps is 1,155, of which 249 have a length greater than

four miles and a half (7,500 metres). They are distributed as follows: in France, 144; Italy, 78; Switzerland, 471; Austria, 462. Their total superficial area is between five hundred and a thousand square miles. The longest is the Aletsch glacier in Austria, measuring over nine miles.

— Dr. Freire of Rio de Janeiro, in a letter to the Louisiana state board of health, thus speaks of the results of his inoculation for yellow-fever: "I have performed over seven thousand inoculations with full success. The immunity was almost absolute, notwithstanding the intensity of the epidemic this year. More than three thousand persons who were not inoculated died of yellow-fever; while among the seven thousand inoculated, inhabiting the same infected localities, subject to the same morbid conditions, but seven or eight individuals, whose disease was diagnosed as yellow-fever, died."

— During the year 1885 there were 246 earthquakes, according to the statistics of C. Detaille, as given in the June number of *Astronomie*. The largest number of these, 49, occurred in January; the smallest, 11, in October. For the other months the numbers are as follows: February, 18; March, 15; April, 19; May, 14; June, 29; July, 23; August, 13; September, 16; November, 16. Only 6 are given for North America, as follows: Jan. 12, Washington; Jan. 18, New Hampshire, Carolina; Jan. 26, California; Feb. 5, Virginia; Nov. 19, California.

— A. Raggi has published some observations on the intermittent variation in sound-perception in the human ear, instances of which are probably familiar to many persons. In deep stillness, if one listens to a faintly heard sound, like that of the ticking of a watch, it will be noticed that at irregular intervals the tones are wholly inaudible, while at other times they are distinctly recognized. Mr. Raggi ascertained, by experiments on different persons, that the intervals of silence usually varied between seven and twenty-two seconds; while the periods of sound-perception were between seven and eleven seconds in duration, with a maximum of fifteen. He also found that the variation was not due to extraneous sounds, nor to the blood-circulation or respiration, and concludes that it results from the inability to keep the attention for long periods at a sufficient degree of tension for the perception of faint sounds, or possibly to a variable physiological receptivity in the auditory nerves.

— A legacy of some $75,000 has been left to the Jena university to be applied in zoölogical research on the basis of Darwin's evolution theory. The testator is Herr Paul von Ritter of Basle, who believes the teaching of Darwin to be the greatest sign of progress which the century has yet given.

— According to the statistics recently published by the minister of agriculture and commerce, it appears that the quantity of olive-oil produced last year, in the various provinces throughout Italy, was 52.34 per cent below the average annual yield, which is calculated at 3,405,500 hectolitres (74,921,000 gallons), it being only 1,782,400 hectolitres (39,212,800 gallons); 11 per cent of this total amount was of superior quality, 73 per cent good, and 16 per cent mediocre.

— The Royal academy of medicine of Belgium has recently offered its largest prize ($5,000) for the most meritorious work or paper on the treatment of diseases of the nervous centres, especially for a remedy for epilepsy. The great need of some better means of controlling this last disease induced the academy to offer an additional prize of $1,600 for the best paper on that subject. The prizes are international, and will be awarded in December, 1888.

— Late deep-sea explorations in the Atlantic, carried on under the auspices of the London geographical society, have shown that the ocean-bottom in the northern region is formed of two valleys, of which one, in width, reaches from the tenth degree of east to the thirtieth of west longitude, extending to the equator, at a depth of not less than thirteen thousand feet. The other lies between the thirtieth and fiftieth degrees of west longitude. The mountain-chain separating the two valleys extends northwards towards Iceland, and southward to the Azores, and is of a volcanic character at its ends. Its greatest breadth is a little less than five hundred miles.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Is the ocean surface depressed?

Do barometric observations give any hint regarding the depression of the sea 'at the centre of the oceans'?

If, as is maintained, there be a depression of a thousand metres, the barometer should show about three inches and a half more pressure at the centre of the oceans than at what we ordinarily call sea-level.

Were there any barometric observations made on the islands where the pendulum was swung? or do barometric observations made on any of the oceanic islands cast any light on this subject? I have no authorities at hand to consult, or would not ask the question.

W. H. S.

Candelaria, Nev., May 25.

The notion that there exist in the sea-surface of the earth elevations and depressions amounting to several hundred metres has recently gained a much

wider acceptance than our knowledge of the facts would seem to justify.

Assuming the continents to be simply so much matter, of half the earth's mean density, on the surface of our otherwise closely centrobaric spheroid, it may be shown that individually they will draw the sea-surface up towards their centres by considerable amounts (about a thousand metres at most), leaving corresponding though not equal depressions opposite those centres; and that collectively they will produce a wavy sea-surface, in which the maximum radial distance from crest to hollow is about six hundred metres. The theory, and the equations assigning the form and position of this wavy surface, have been developed by Helmert in his excellent treatise on geodesy ('Die mathematischen und physikalischen theorieen der höheren geodäsie'), from which the above figures have been taken. If we dropped our examination of the question at this point, we might infer the reality of the wavy surface just described. The existence of such assumed continents, however, implies a proportionate variation of gravity along the sea surface and along the same level surface extended through the continents. They would, for the most part, produce an excess of gravity over the continental and a deficiency over the sea areas. But this conclusion is in direct contradiction with the results of pendulum experiments. The assumption, therefore, that the continents are superficial masses, unbalanced in their attractive effects, is, as clearly shown by Helmert, inadequate, and must, together with the conclusions based thereon, be modified or rejected.

Some writers, notably Fischer and Listing, have proved the existence of a highly irregular sea-surface by a still more unsound process than that indicated above would be if we neglected to examine its fundamental assumption. This process, in brief, rejects in an equation a term of the same order as those retained, and arrives at a simple relation between the variation of gravity and the radial distance from the actual sea-surface (or geoid) to the mean spheroidal surface. Helmert fitly characterizes this relation as entirely worthless (*ganz wertlos*), since it fails in every case to give the proper sign when the increments of gravity and radial distance due to the combined action of the continents are substituted in it.

Those desiring to examine minutely the merits of this question should consult the above-named treatise of Helmert, who gives a critical review of the cognate works of Fischer, Listing, Bruns, and others. For the benefit of the general reader, it may be stated, that, although the sea-surface is undoubtedly somewhat irregular, geodesy and geology have as yet furnished no adequate evidence of irregularities amounting to more than ten metres. Additional information, of which it must be admitted there is great need, may disclose the existence of a surface having hills and hollows separated by an interval of fifty or possibly a hundred metres; but irregularities of any greater extent appear to be quite improbable.

The suggestion of your correspondent, that the barometer would indicate any large elevations or depressions in the sea-surface, is not well grounded. The surfaces of equal pressure in the atmosphere must approximate to parallelism with the sea-surface, however irregular it may be. In a state of quiescence the air-surface in contact with the sea is necessarily a surface of equal pressure. The barometer would therefore, if moved from one point to another along the sea-surface, register only such variations in pressure as are due to changes of temperature, winds, etc., and hence afford no indication of the elevations and depressions in question, if they exist.

R. S. WOODWARD.

Washington, D.C., June 17.

Barometer exposure.

Mr. Clayton's letter concerning the influence of wind on the indication of the barometer broaches a subject of great importance to theoretic and practical meteorology, and I trust it may lead to the execution of the experiments essential to the intelligent treatment of the difficulty. As his conclusions are called in question by President LeConte, I take the liberty of rehearsing some investigations of my own which tend to sustain Mr. Clayton's conclusions.

In June, 1873, an elaborate series of synchronous barometric observations were made by the signal office at four stations on the summit and slope of Mount Washington. In testing a special method of barometric hypsometry, I had occasion to discuss these observations, and I discovered an important anomaly which was correlated with the velocity and direction of the wind. The discussion cannot be repeated here, for lack of space; but it may be said that its method and material were such as to leave no reasonable doubt that the wind was the disturbing factor, while they afforded quantitative results far more precise than can be reached by any method of reduction to sea-level. The reader who cares to examine them should consult the 'Second annual report of the U. S. geological survey,' pp. 521–534 and 562–565. One of the specific conclusions was, that a northwest wind of fifty miles per hour, by drawing air out of the summit observatory, presumably through the chimney, caused the mercury in the barometer to stand .13 of an inch too low; and it was estimated that a wind-velocity of a hundred miles would lower the mercury more than half an inch.

I think President LeConte is mistaken in supposing that the matter could be simply tested by comparing the indications of a barometer in a room with those of a barometer out of doors. If the out-of-door barometer were placed on the windward side of a building or other obstruction, and close to it, it would be immersed in compressed air, and read too high. If placed under the lee of an obstruction, it would be surrounded by relatively rarified air, and read too low. If placed in a position uninfluenced by obstructions, the locus of difficulty would be transferred from the surrounding atmosphere to the instrument itself, for the air chamber above the mercury in the cistern of the barometer would itself be influenced by the wind so as to receive a tension abnormally high or low. These statements, based on familiar physical laws, are not individually susceptible of ready verification, because, while the wind blows, all local tensions are disturbed, and we have no standard air-pressure for comparison. I have, however, determined experimentally that the reading is higher in front of an obstruction than behind it. A difference of .15 of an inch was found between barometer-readings on opposite sides of the apex of an acute mountain-peak.

In my opinion, the proper method of escaping the difficulty is, not to place the barometer out of doors, where observation during a wind is itself a matter

of difficulty, but to so arrange the observatory that the influence of the wind shall be either measured and subtracted, or avoided altogether. Place the barometer in an air-tight box, made partly of glass for purposes of observation, and connect this box by a tube with an opening on the roof so adjusted that it shall always sustain the same relation to the wind. It is possible that a form of opening can be devised such that the wind will neither compress nor dilate the air within the box; but, if this cannot be done, it is certainly possible, by a proper system of experiments, to determine for a given arrangement of aperture the proper correction to apply to the barometer-reading for each measured velocity of wind. The matter should receive thorough investigation.

G. K. GILBERT.

Washington, June 19.

I infer from Prof. John LeConte's letter in your last issue (*Science*, vol. vii. p. 550) that he does not feel entirely satisfied with the explanation I have offered of the slight fluctuations of the barograph observed at Blue Hill during high winds. He says, "The observed facts are, that fluctuations of wind-velocity correspond with fluctuations of air-pressure. In some cases it may be difficult to decide which is cause, and which is effect." In this case, the fact, as stated in my last letter, that I could produce these fluctuations at will by merely opening and closing a hatchway in the top of the building, seems to me to prove conclusively that the wind was the cause, and the change in the pressure the effect. In regard to his suggestion that a comparison should be made between a barograph inside and one outside of the building, I think, before satisfactory results could be obtained, it would first have to be proven that the wind in blowing across the top of the barometer cistern, or at right angles to the crevices of such cistern, would not have the same effect of lowering the readings of the barometer outside as well as inside of the building.

Mr. E. B. Weston of Providence has informed me that he has noticed during high winds small oscillations of his barograph, similar to those observed at Blue Hill, and has prevented them by opening the windows, so as to give a free draught of air. I tried the same at Blue Hill during a late high wind, and found that the oscillations, which at most were slight, were reduced by it.

In regard to those large differences between the observed and estimated pressure on Mount Washington, referred to in my last as collected by Professor Loomis, it is probable, that, in these extreme cases, other causes than that suggested by me become factors in the result; such, for instance, as a lagging of the time of minimum pressure at the top as compared with the base, and a more violent cyclonic circulation of the wind at that height, — causes which have been suggested by Professor Loomis in his twentieth paper (*Amer. journ. sc.*, vol. xxviii. July, 1884).

H. HELM CLAYTON.

Blue Hill meteor. observ., June 19.

A most extraordinary structure.

Referring to P.Z.S. 1885, p. 908, pl. lxi. fig. 3, *h*, where my amiable young friend Dr. Shufeldt describes and figures the humerus of a humming-bird as 'a most extraordinary structure,' I may be permitted to suggest that some of the alleged 'eccentricities' of this 'unique' bone might seem less if he had not got the bone turned hind part before by one of those strokes of genius which a prosaic world, steeped in materialism, is slow to appreciate.

A THEOSOPHIST.

Smithsonian institution,
Washington, June 15.

Aspects of the economic discussion.

I have just read Professor Newcomb's article (*Science*, vii. No. 176) on the new school of political economy. It seems to me that the professor asks for too much in the way of results from the new school. As I understand it, this is simply a question of methods. The new school professes the historical method, as opposed to the deductive method of the so-called orthodox school. If the historical method is right, the results eventually arrived at will, nay must, be right. But to stop them on their way as if with a revolver, and demand a categorical statement of their views on such disputed points as state interference before they are allowed to finish their journey, is certainly unwarranted.

Whatever results the new school may reach, it is tolerably certain that they will eliminate from the books that monster of imagination the 'economic man,' and that other *chimaera bombans in vacuo*, the hypothetical 'consumer,' who does nothing in this world but eat.

When they shall have rebuilt the science on their new foundation, it will be soon enough to demand from them an account of their views on such questions as Professor Newcomb propounds.

WM. A. INGHAM.

333 S. 16th St., Philadelphia, June 18.

Distribution of colors in the animal kingdom.

In the notice of Camerano's 'Distribution of colors in the animal kingdom' (*Science*, vii. p. 557) I notice the astonishing statement that green 'never occurs among mollusks.' On the contrary, it is one of the most common colors of mollusks, especially among fresh-water species. Examples will occur to the most superficial observer in the genera Anodonta, Unio, Campeloma, Anculotus, etc. Among land-shells the arboreal helices of tropical countries are noted for their magnificent greens. Among marine shells, it is notable in many species of Mytilus, Modiola, Tellina, Prasina, etc., among pelecypods; Nerítina, Chlorostoma, Turbo (where the calcareous operculum, also, is often stained with green), Haminea, and many other gastropods; not to speak of the nudibranchs, which frequently exhibit different shades of green. The rarest color among mollusks is pure blue (as distinguished from the rather common bluish violet), but even this color is found of great brilliancy in some cases. The assertion objected to is one more bit of evidence to the general neglect among biologists, otherwise well equipped, to gain any general knowledge of the Mollusca, except that supposed to be afforded by theoretical views taken from out worn text-books. There are perhaps a dozen first-class general conchologists in the world, none of whom are young. The prospect now is that the next generation will not have any. The reasons seem to be, among others, the shocking state into which amateurs and superficial students have brought the nomenclature, and the fact that the scientific training to be had in our best colleges leads in altogether different directions.

WM. H. DALL.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 25, 1886.

THE PHYSICAL LABORATORY IN MODERN EDUCATION.[1]

From the moment we are born into this world, down to the day when we leave it, we are called upon every moment to exercise our judgment with respect to matters pertaining to our welfare. While nature has supplied us with instincts which take the place of reason in our infancy, and which form the basis of action in very many persons through life, yet more and more as the world progresses, and as we depart from the age of childhood, we are forced to discriminate between right and wrong, between truth and falsehood. No longer can we shelter ourselves behind those in authority over us, but we must come to the front, and each one decide for himself what to believe and how to act in the daily routine and the emergencies of life. This is not given to us as a duty which we can neglect, if we please, but it is that which every man or woman, consciously or unconsciously, must go through with.

Most persons cut this gordian knot, which they cannot untangle, by accepting the opinions which have been taught them, and which appear correct to their particular circle of friends and associates: others take the opposite extreme, and, with intellectual arrogance, seek to build up their opinions and beliefs from the very foundation, individually and alone, without help from others. Intermediate between these two extremes comes the man with full respect for the opinions of those around him, and yet with such discrimination that he sees a chance of error in all, and most of all in himself. He has a longing for the truth, and is willing to test himself, to test others, and to test nature, until he finds it. He has the courage of his opinions when thus carefully formed, and is then, but not till then, willing to stand before the world and proclaim what he considers the truth. Like Galileo and Copernicus, he inaugurates a new era in science, or, like Luther, in the religious belief of mankind. He neither shrinks within himself at the thought of having an opinion of his own, nor yet believes it to be the only one worth considering in the world; he is neither crushed with intellectual humility, nor yet exalted with intellectual pride; he sees that the problems of nature and society can be solved, and yet he knows that this can only come about by the combined intellect of the world acting through ages of time, and that he, though his intellect were that of Newton, can, at best, do very little toward it. Knowing this, he seeks all the aids in his power to ascertain the truth; and if he, through either ambition or love of truth, wishes to impress his opinions on the world, he first takes care to have them correct. Above all, he is willing to abstain from having opinions on subjects of which he knows nothing.

It is the province of modern education to form such a mind, while at the same time giving to it enough knowledge to have a broad outlook over the world of science, art, and letters. Time will not permit me to discuss the subject of education in general, and, indeed, I would be transgressing the principles above laid down if I should attempt it. I shall only call attention, at this present time, to the place of the laboratory in modern education. I have often had a great desire to know the state of mind of the more eminent of mankind before modern science changed the world to its present condition, and exercised its influence on all departments of knowledge and speculation. But I have failed to picture to myself clearly such a mind; while, at the same time, the study of human nature, as it exists at present, shows me much that I suppose to be in common with it. As far as I can see, the unscientific mind differs from the scientific in this, that it is willing to accept and make statements of which it has no clear conception to begin with, and of whose truth it is not assured. It is an irresponsible state of mind without clearness of conception, where the connection between the thought and its object is of the vaguest description. It is the state of mind where opinions are given and accepted without ever being subjected to rigid tests, and it may have some connection with that state of mind where every thing has a personal aspect, and we are guided by feelings rather than reason.

When, by education, we attempt to correct these faults, it is necessary that we have some standard of absolute truth; that we bring the mind in direct contact with it, and let it be convinced of its errors again and again. We may state, like the philosophers who lived before

[1] Address delivered at the tenth anniversary of the Johns Hopkins university.

Galileo, that large bodies fall faster than small ones; but, when we see them strike the ground together, we know that our previous opinion was false, and we learn that even the intellect of an Aristotle may be mistaken. Thus we are taught care in the formation of our opinions, and find that the unguided human mind goes astray almost without fail. We must correct it constantly, and convince it of error over and over again, until it discovers the proper method of reasoning, which will surely accord with the truth in whatever conclusions it may reach. There is, however, danger in this process that the mind may become overcautious, and thus present a weakness when brought in contact with an unscrupulous person, who cares little for truth and a great deal for effect. But if we believe in the maxim that truth will prevail, and consider it the duty of all educated men to aid its progress, the kind of mind which I describe is the proper one to foster by education. Let the student be brought face to face with nature; let him exercise his reason with respect to the simplest physical phenomenon, and then, in the laboratory, put his opinions to the test: the result is invariably humility, for he finds that nature has laws which must be discovered by labor and toil, and not by wild flights of the imagination, and scintillations of so-called genius.

Those who have studied the present state of education in the schools and colleges tell us that most subjects, including the sciences, are taught as an exercise to the memory. I myself have witnessed the melancholy sight, in a fashionable school for young ladies, of those who were born to be intellectual beings reciting page after page from memory, without any effort being made to discover whether they understood the subject or not. There are even many schools, so called, where the subject of physics or natural philosophy itself is taught, without even a class experiment to illustrate the subject and connect the words with ideas. Words — mere words — are taught, and a state of mind far different from that above described is produced. If one were required to find a system of education which would the most surely and certainly disgust the student with any subject, I can conceive of none which would do this more quickly than this method, where he is forced to learn what he does not understand. It is said of the great Faraday that he never could understand any scientific experiment thoroughly until he had not only seen it performed by others, but had performed it himself. Shall we, then, expect children and youth to do what Faraday could not do? A thousand times better never teach the subject at all.

Tastes differ, but we may safely say that every subject of study which is thoroughly understood is a pleasure to the student. The healthy mind as well as the healthy body craves exercise, and the school-room or the lecture-room should be a source of positive enjoyment to those who enter it. Above all, the study of nature, from the magnificent universe, across which light itself, at the rate of 186,-000 miles per second, cannot go in less than hundreds of years, down to the atom of which millions are required to build up the smallest microscopic object, should be the most interesting subject brought to the notice of the student.

Some are born blind to the beauties of the world around them, some have their tastes better developed in other directions, and some have minds incapable of ever understanding the simplest natural phenomenon; but there is also a large class of students who have at least ordinary powers and ordinary tastes for scientific pursuits. To train the powers of observation and classification, let them study natural history, not only from books, but from prepared specimens or directly from nature; to give care in experiment, and convince them that nature forgives no error, let them enter the chemical laboratory; to train them in exact and logical powers of reasoning, let them study mathematics: but to combine all this training in one, and exhibit to their minds the most perfect and systematic method of discovering the exact laws of nature, let them study physics and astronomy, where observation, common sense, and mathematics go hand in hand. The object of education is not only to produce a man who *knows*, but one who *does*; who makes his mark in the struggle of life, and succeeds well in whatever he undertakes; who can solve the problems of nature and of humanity as they arise; and who, when, he knows he is right, can boldly convince the world of the fact. Men of action are needed as well as men of thought.

There is no doubt in my mind that this is the point in which much of our modern education fails. Why is it? I answer, that the memory alone is trained, and the reason and judgment are used merely to refer matters to some authority who is considered final, and, worse than all, they are not trained to apply their knowledge constantly. To produce men of action, they must be trained in action. If the languages be studied, they must be made to translate from one language to the other until they have perfect facility in the process. If mathematics be studied, they must work problems, more problems, and problems again, until they have the use of what they know. If they study the sciences, they must enter the laboratory, and stand face to face with nature; they must learn to test their knowledge constant-

ly, and thus see for themselves the sad results of vague speculation; they must learn by direct experiment that there is such a thing in the world as truth, and that their own mind is most liable to error; they must try experiment after experiment, and work problem after problem, until they become men of action, and not of theory.

This, then, is the use of the laboratory in general education, — to train the mind in right modes of thought by constantly bringing it in contact with absolute truth, and to give it a pleasant and profitable exercise, which will call all its powers of reason and imagination into play. Its use in the special training of scientists needs no remark, for it is well known that it is absolutely essential. The only question is, whether the education of specialists in science is worth undertaking at all; and of these I have only to consider natural philosophers or physicists. I might point to the world around me, to the steam-engine, to labor-saving machinery, to the telegraph, to all those inventions which make the present age the 'age of electricity,' and let that be my answer. Nobody could gainsay that the answer would be complete; for all are benefited by these applications of science, and he would be considered absurd who did not recognize their value. These follow in the train of physics, but they are not physics: the cultivation of physics brings them, and always will bring them: for the selfishness of mankind can always be relied upon to turn all things to profit. But in the education pertaining to a university we look for other results. The special physicist trained there must be taught to cultivate his science for its own sake. He must go forth into the world with enthusiasm for it, and try to draw others into an appreciation of it, doing his part to convince the world that the study of nature is one of the most noble of pursuits, that there are other things worthy of the attention of mankind besides the pursuit of wealth. He must push forward, and do what he can, according to his ability, to further the progress of his science.

Thus does the university, from its physical laboratory, send forth into the world the trained physicist to advance his science, and to carry to other colleges and technical schools his enthusiasm and knowledge. Thus the whole country is educated in the subject, and others are taught to devote their lives to its pursuit, while some make the applications to the ordinary pursuits of life that are appreciated by all.

But for myself I value in a scientific mind most of all that love of truth, that care in its pursuit, and that humility of mind, which makes the possibility of error always present more than any other quality. This is the mind which has built up modern science to its present perfection, which has laid one stone upon the other with such care that it to-day offers to the world the most complete monument to human reason. This is the mind which is destined to govern the world in the future, and to solve problems pertaining to politics and humanity as well as to inanimate nature.

It is the only mind which appreciates the imperfections of the human reason, and is thus careful to guard against them. It is the only mind that values the truth as it should be valued, and ignores all personal feeling in its pursuit. And this is the mind the physical laboratory is built to cultivate. HENRY A. ROWLAND.

THE FORMATION OF STRUCTURELESS CHALK BY SEAWEEDS.

CHALK has hitherto been believed to be a deep-sea formation only, made up of a fine ooze or mud at great depths, and undoubtedly, so far as the extensive cretaceous deposits are concerned, the explanation is the correct one; but recent observations by Mr. J. Walther on the chalk-secreting algae of the Mediterranean show that its formation often occurs in shallow water. It has been known for some time that the nullipores were chalk-secreting algae, and that under certain conditions, as in the formation of coral islands, they took more or less part in the production of rock. Where their remains are found in any abundance, chalk formations are readily enough ascribed to their agency, but it is now shown that more or less extensive beds, or rather banks, of wholly structureless chalk, whose origin has been oftentimes enigmatical, may be entirely due to seaweeds.

Mr. Walther observed certain forms (Lithothamnia) in different places in the Gulf of Naples, growing luxuriantly at a depth of from one to three hundred feet below the surface, and traced out the relation between the masses of dead residual matter and the incompletely transformed beds of fossil chalk. These Lithothamniae have a remarkably small proportion of organic material (not more than five or six per cent), nearly the entire substance consisting of mineral matter, chiefly carbonate of lime. The plants reach only the size of one's fist, and do not change their form at death, owing to the small quantity of decaying matter they contain. The living plants secure attachment to the dead ones, forming extensive beds. The numerous stout branches of less than a fourth of an inch in length admit of only small interstices; in slow-growing beds inequalities and shallow depressions may be filled with layers of detritus.

The organic structure disappears to a greater or

less extent, often wholly, so that the chalk becomes entirely structureless; and it has been shown that the absence of structure becomes more apparent in proportion to the greater thickness of beds formed. The further transformation was traced by Walther in a recent tertiary formation at Syracuse, where he found, in the exposed quarries of Latomia dei Capuccini, the remains of Lithothamnia sufficiently distinct for determination, especially where the interstitial material had been weathered out. The stone, however, blended from this indistinctly structural form to the wholly structureless or homogeneous.

The explanation of this complete transformation, as given by the author, is also of interest. The organic substances, which in the living plant amount to about five or six per cent, were found, in the tertiary chalk above referred to, to be about a third of one per cent. The larger part had thus disappeared; and as the chalk was purely white, showing the absence of all bituminous matter, it was evident that the remaining organic matter had slowly been oxidized, producing carbonic matter, which had obliterated by its dissolving action in the surrounding or percolating water all evidences of structure. In such cases where the plants were exposed to water not impregnated with the carbonic acid, the structure is retained more or less unimpaired.

This explanation of the formation of chalk in shallow waters — for algae must live within a few hundred feet of the surface, where light can reach them — gives a solution of various problems in geology, especially of the more recent chalk-beds. Whether it will apply to the extensive structureless chalk-beds of western Kansas at all, is doubtful.

CYPRUS UNDER BRITISH RULE.

AT a recent meeting of the Society of arts, in London, Mr. G. Gordon Hake read a paper on the condition of Cyprus since its occupation by the British, his object being to show the improvements that have taken place under the new administration.

In ancient times Cyprus was one of the most fertile and prosperous countries in the world, its copper and its timber being important articles of commerce. But under the Turkish administration the island deteriorated greatly, as most countries do under Turkish rule. One traveller, near the end of the last century, describes Famagusta, at the time of his visit, as a "melancholy picture of Turkish desolation," and as "almost depopulated, although, in the time of the Venetians, the finest city in the island, and renowned for its brave defence against the infidels." He adds, "The desolation we observed at Famagusta extended itself along the country. We passed by the ruins of several Greek villages." Another traveller also gives a sad account of Cyprus at a rather later date. "The island," he says, "was formerly one of the richest and most fertile in the world. It is much exposed to the ravages of locusts. On their approach, every kind of verdure disappears, and they even gnaw the very bark off the trees. The Turks will not permit their destruction, because they consider them as sent by the Almighty."

This melancholy condition of the island was due in part to maladministration of justice, and in part to a vicious system of taxation. The Turkish government took tithes of the produce of the land, and these tithes were farmed in the spring of each year to merchants and speculators. This system had its natural results in a loss of revenue to the state, and the impoverishment of the cultivator, whom it involved in the toils of the money-lender, as well as the tithe-farmer, and thus checked the productiveness of the island to an enormous extent. The land, falling out of cultivation, became the breeding-ground of locusts. The cultivators of the soil in many cases gave up their calling in despair, and obtained a living by cutting down and selling trees, and the collection of resin. The wholesale destruction of trees reacted on the climate, and restricted the rainfall; so that between locusts, tithe-farmers, and neglect of the forests, the island, at the time of the occupation, was rapidly becoming more like a barren, rocky desert than a fertile and naturally favored country.

These, then, were the chief evils to be remedied by the English on their arrival in Cyprus. It was at once made plainly known that no farming of tithes would be allowed under British rule; and it was decided to adopt the following course in regard to the same. The Turkish plan of assessment was to be followed, but, instead of collecting the tithes in kind, they were to be valued, and, leaving the peasant free to deal with his crop as he pleased, the money value was to be collected as an ordinary tax later in the year. The sole exceptions to this were the tithes on silk and carobs. The greater portion of these two products being exported from the island, it was arranged to collect the tithe on export, and so save the cost of assessment; and the result, besides being successful from the imperial point of view, has given great satisfaction to the agriculturists.

After this financial reform the locust and timber questions remained to be dealt with. The Cyprus locust is indigenous to the island; and its presence is, without doubt, largely due to past

mismanagement and neglect of the soil, inasmuch as it is only on rocky waste ground that the female insect will lay her eggs. The locust-plague is therefore the result of inadequate cultivation of the soil, consequent upon a deficiency of population, coupled with an insufficiency of trees; though their increase may be largely attributed to the Mussulman theory of resignation, which would not, in former times, permit their destruction on account of the belief that they were sent by the Almighty. For some years prior to 1862 the destruction of crops from this cause was very large, and the plan of egg-collection was then tried, without success, by the Turkish government. This led Mr. Richard Mattei, a land-owner of Cyprus, to commence a series of experiments, which resulted in the invention of his system of traps and screens. Mr. Mattei had the good fortune to secure the assistance of the Turkish governor, Said Pacha, a man of exceptional intelligence and energy; and in 1870, after long effort, the locusts were by this means almost exterminated. Not wholly, however; for in 1875 they reappeared, and, another governor being in power, they were allowed to increase until the time of the British occupation. Early in 1879, measures were adopted by the English government, both by the employment of Mr. Mattei's trap and screen system and by encouraging the collection of locust-eggs, for which they offered a considerable price. These measures have been completely successful, as the locusts that appeared last year were comparatively few in number, and did no appreciable damage, and any future visit may be looked forward to with complacency.

But the forests of the island also demanded and received the attention of the new authorities. The forests were placed under control, and the destruction of wood prohibited, moderate supplies being permitted for native wants. The indiscriminate pasturage of goats has been stopped, and a large number of trees have been planted, the chief species being Aleppo pine, cypress, carob, ailantus, oak, mimosa, eucalyptus, and Pinus pinea. The effect of these measures has been favorable; but the restoration of the forests must necessarily be a work of time.

Again, it was necessary to reform the administration of justice throughout the island. This was effected by a complete re-organization of the department of justice under the direction of the home government. The most salient features of the scheme were the formation of a court of appeal, composed of two qualified English judges, the appointment of an English judge to preside in every district, and the establishment of a number of village judges to deal with petty civil cases. It included also the adequate payment of the native judges, although their number was gradually reduced to a considerable extent, and likewise established a system of jail deliveries by judges on circuit, similar to that which prevails in England.

The effect of these and other less important reforms on the commerce of the island has been highly beneficial. The abolition of the tithe-farming system, and the adoption of the more generous as well as more politic measure, whereby the agriculturist was permitted to deal with his crop as he pleased, the collection of the tax being delayed till a later season, when he should have had ample time for the conversion into money of the produce of his holding, had a most favorable influence on the particular industries affected, and consequently on the trade of the island generally. The volume of foreign trade, which in Turkish times was estimated at £1 10s. per head of the population, amounted, in 1879, to £2; in 1880, to £2 10s.; and in 1881, to £3 per head, since which time steady increases have been recorded. The net result of British occupation to Cypriot commerce may be fairly estimated by a comparison of the respective imports and exports for 1878, the last year of Ottoman rule, with those of 1884–85. The imports for 1878 were £177,651; for 1884–85, £304,375. The exports in 1878 were £157,328; last year they amounted to £287,521; and the figures were still higher the year before, especially as regards the imports.

Mr. Hake concluded his paper with a few remarks on the further improvements which he deems necessary for the prosperity of the island. Leaving out of account all minor measures, such as developing certain crops, he thinks there are three things which remain for the English to do. The first is to become the purchasers of the fee simple of the island, instead of being tenants at will, as they are at present; the second is to spend money, even to the extent of getting into debt, in order to plant the moutain-ranges, and especially the northern one that runs down the Mesaorian plain; and the third is (again getting into debt, if necessary) the establishment of a railway from Morphou to Famagusta, leaving its after-development to time, and to put the harbor of Famagusta into proper repair for mercantile use.

JEVONS'S LETTERS AND JOURNAL.

MRS. JEVONS has done well to collect these letters and journals of her late husband. The world is always interested in the personal history

Letters and journal of W. Stanley Jevons. Ed. by his wife. London, *Macmillan*, 1886. 8°.

of its benefactors; and, in the case of those whose lives are uneventful, this can only be known from their own private papers and those of their friends. Jevons was not, indeed, a man of the highest genius, and his works are not likely to make an epoch in any department of knowledge; but they are fresh in thought and often original, and nearly always provocative of thought in his readers. Moreover, he wrote a clear and easy style, which makes his letters interesting from a literary point of view.

Most of the letters in the collection before us were written to his relatives and personal friends, though many of the later ones are addressed to correspondents in the learned world. The most interesting part of the book to us is that which treats of the author's education and his early labors in the mental and social sciences. William Stanley Jevons was born in Liverpool in 1835, and met his death by drowning, at Bulverhythe, near Hastings, in 1882; so that his life covered a period of not quite forty-seven years. His father was a merchant, but failed while Stanley was a boy, after which the family were in only moderate circumstances. Stanley's mother died while he was very young, and he was taught at home by a governess until he was more than ten years old, when he was sent to school in Liverpool. At the age of fifteen he went to London to attend University college school, and afterwards studied at the college itself till he reached the age of nineteen. At that time he was offered the position of assayer in the mint at Sydney, in Australia; and, though at first averse to taking it, he ultimately accepted and retained the post for four years. The duties of the office seem never to have been much to his taste, and he had not held it long when he began to entertain designs and aspirations which rendered a return to England necessary. What these designs were he makes known in a letter to his sisters. He writes that in his inmost soul he has but "one wish, or one *intention*, viz., to be a *powerful good* in the world. To be *good*, to live with good intentions towards others, is open to all. . . . To be *powerfully good*, that is, to be good, not towards one, or a dozen, or a hundred, but towards a nation or the world, is what now absorbs me. But this assumes the possession of the *power*. . . . I also think, that, if in any thing I have the chance of acquiring the power, it is that I have some *originality*, and can strike out new things" (pp. 95, 96).

It appears, also, from another of his letters, that he had also chosen the field in which he was to work; for he writes that he intends "exchanging the physical for the moral and logical sciences, in which my *forte* will really be found to lie."

With such aspirations as these, Jevons could not be content to remain in Australia; and accordingly in 1859 he left his post at Sydney, and returned to England by way of Panama and the United States. On reaching home, he returned to study at University college, where he remained till he had taken the degree of M.A., devoting himself mainly to mental and social philosophy. After finishing his studies, he was for some time in doubt as to how he was to get his living, but was soon offered a position as tutor in Owens college, Manchester, which he accepted, being then twenty-eight years of age. A few years later he was appointed professor of philosophy and political economy in the same institution, and not long afterwards he married.

He had now attained a position which enabled him to carry on his chosen work, and he had already published some essays which had given him a reputation as an economist and statistician. The most important of these was the one on the coal-question, in which he warned his countrymen that their supply of coal was not inexhaustible. These essays did not at first attract the notice he expected, and, as he had not then attained his professorship, he seems to have suffered much from depression of spirits. Yet he did not swerve in the least from his chosen path; for he writes in his journal as follows: "Whence is this feeling that even failure in a high aim is better than success in a lower one? It must be from a higher source, for all lower nature loves and worships success and cheerful life. Yet the highest success that I feel I can worship is that of adhering to one's aims, and risking all" (p. 218). The next day after this was written, he received a letter from Mr. Gladstone, warmly commending his pamphlet on the coal-question; and from this time onward his reputation continued to grow.

Of the author's works, however, we have no space to speak at length. We cannot accord him a place among the great thinkers of the world, and it seems to us that he tried to be more original than he had the power to be, though his works are very suggestive. His mathematical theory of political economy has not been accepted by any leading thinker, and has remained thus far without influence on the development of the science. He urges that economical phenomena can be treated mathematically, because they can be expressed in terms of more and less; but, in order to treat them mathematically, we must be able to say how much more or less, and this, in the case of human desires and efforts, is impossible. Again: Jevons seems to have thought, that, in his doctrine of 'the substitution of similars,' he had presented an entirely new theory of reasoning; whereas the

doctrine in question is the basis of every system of logic in existence, and necessarily so.

Jevons was perhaps a little too apt to present his thoughts to the public before he had given them time to mature, and hence some of his theories are crude and but half worked out. Indeed, he seems in some cases to have been aware of this himself; for he writes to one of his correspondents about the 'Principles of science,' in the following terms: "To the want of a psychological analysis of the basis of reasoning I plead guilty. . . . No doubt, to a considerable extent I have avoided the true difficulties of the subject; but this does not preclude me from attempting to remedy the defect at some future time, if I live long enough, and can feel that I see my way to a more settled state of opinion" (p. 322). But, unfortunately for him and for us, he did not live long enough to finish this and other tasks that he had projected; and it is sad to think how much the world may have lost by the death, at the age of forty-six, of a man of such freshness of thought, and courage of opinion, as Jevons undoubtedly showed.

THE RAILWAYS AND THE REPUBLIC.

CAN competition be so arranged as to prevent the more serious abuses of railroad power? Can it be made to apply to railroads as it does to most other lines of business? Fifty years' experience has seemed to show that it cannot. Mr. Hudson believes that it can; and he makes out a case which will appear plausible to those who are not in a position to understand the practical difficulties involved in his project.

Each year's history shows that under our existing system — or want of system — railroad managers wield an irresponsible power, dangerous alike to shippers and to the government. By arbitrary differences in charge they can ruin the business of individuals; by political corruption they can often thwart all attempts at government control. The history of the Standard oil company, which Mr. Hudson tells extremely well, furnishes an instance of both these things. The railroads made a series of contracts with the company to do its business at much lower rates than they would give to any one else; while the railroads and the company together were able to set at nought the plainest principles of common law, to defy legislative investigation, and laugh at state authority itself.

What is to be done under these circumstances? This is the question to which Mr. Hudson addresses himself. He does not fall into the extreme of advocating state ownership. He has too strong a sense of the dangers of government management to believe that political corruption could be avoided, or enlightened economy secured, by a measure like this. Admitting, then, that railways are to remain under private ownership, how are their abuses to be brought under control? Almost every writer has his own notion on the subject, and his own individual shade of opinion; but we may group them under three main heads: —

1. There is one class of writers who insist that things are well enough as they are; who say that the reduction in rates under our present system has been so great, and the development of the country so rapid, as to outweigh any incidental evils which may exist. They say that the most we can possibly think of doing is to prohibit a few of the worst abuses, and perhaps secure a very moderate amount of publicity; and that other things will take care of themselves. This is the position of writers like Stuart Patterson or Gerritt Lansing.

2. Many of the more enlightened railroad men, like Albert Fink, G. R. Blanchard, or Charles Francis Adams, jun., do not deny the existence of most serious evils; but they attribute them to unrestricted competition, which favors competing points at the expense of local points, or places solvent roads at the mercy of bankrupt ones. They favor legalizing pools, and limiting the irresponsible construction of new roads, and think that the public interest would be best served by a responsible combination of railroads, with a commission to see that the interests of the shippers were not neglected.

3. On the other hand, Mr. Hudson insists that we have, not too much competition, but too little; that the abuses incident to its partial and irregular working can be best avoided by enabling it to act everywhere instead of nowhere. This he proposes to do by allowing others besides the railway company to use the track, on payment of a just and reasonable toll. He argues strongly to prove that this plan is not merely equitable, but practicable, and that each of the other positions is wrong, both in fact and in morals.

He has no difficulty in breaking down the arguments of the first group. The men who insist that railroad management is a private business, with which there should be no interference, and that all is well enough as it is, are every day becoming fewer. The really difficult conflict is against those who admit the evils, but who say that the remedy is to be found in well-controlled combination rather than uncontrolled competition. Mr. Hudson insists that combinations perpetrate outrages which individual roads could not perpe-

The railways and the republic. By JAMES F. HUDSON. New York, *Harper*, 1886. 8°.

trate, and that the worst abuses of railroad wars have their origin in the desire to force rival roads to a combination. Against the first of these points we may cite the testimony of Mr. Sterne, — certainly no prejudiced witness, — that the actual abuses have been lessened rather than increased when the trunk-line pool was in operation. We may cite the uniform experience of Europe, that only where pooling contracts were made permanent has it been possible to bring discrimination under control; so that men as widely distinct in their views as Gladstone and Bismarck have both sanctioned the system by their active countenance. With regard to the motive for railroad wars, we may show that it is regularly the weaker party who is the aggressor, rather than the stronger party. And finally, as a counter-argument against Mr. Hudson, it may be shown that his scheme has been found impracticable. It was tried and abandoned at the outset, as he himself admits. Every subsequent change in railroad administration has rendered the difficulties of its application greater instead of less. Both by theory and by experience, it may be shown that the attempt to treat the railway as a public highway has done some harm and no good in the past, and must grow even less possible with the increasing complication of railroad business.

OPPOLZER'S TREATISE ON ORBITS.

OPPOLZER'S treatise on the determination of the orbits of planets and comets is so well and so favorably known to students of astronomy, that, in calling attention to the French translation of the first volume (which will be found welcome by those who do not read German with ease), we might have confined ourselves to the briefest notice, if the translator had reproduced the German edition without modification. M. Pasquier has, however, introduced, together with several minor changes, the mode of counting longitude and time recommended by the Washington international meridian congress of 1884: that is, longitudes east from Greenwich are regarded as plus, and west as minus; and the astronomical day is made to begin with mean midnight. This innovation is in accord with the ideas of Dr. Oppolzer, who is known as one of the strongest and most distinguished of the advocates of the new plan. M. Pasquier says that the change has been made in response, also, to the wishes of the majority of astronomers and of governments. It is difficult to see upon what ground such a conclusion is drawn in regard to the wishes of astronomers; the opinions published during the past year are far from indicating a majority in favor of the change; and diplomatic action, even if ratified by the countries represented, can scarcely be expected to influence astronomers in such an important matter. The course adopted by M. Pasquier we are inclined to regard as somewhat premature, and it may interfere with the general acceptance and usefulness of the translation as a text-book; but he has taken care to indicate in his preface the corrections which must be made in the text and tables, if one prefers to reckon the astronomical day from mean noon (the present custom) instead of using universal time. To quote a recent comment, "a glance at these corrections will show astronomers some of the troubles that are in store for them, should they make the change which the Washington conference has recommended."

The typography of the volume is good (we are always sorry, though, to meet with the flat-topped figure three (3), an abomination when it is found on divided circles and micrometer heads, and scarcely more legible in print), and especial pains have been taken to insure accuracy in the tables and formulae. The tables, we are told, were revised three times while the work was going through the press.

Traité de la détermination des orbites des comètes et des planètes. Par THEODORE D'OPPOLZER. Tr. by Ernest Pasquier. Vol. 1. Paris, *Gauthier-Villars*, 1886. 4°.

THE fourth volume of the 'Publications of the Washburn observatory,' which we have just received, seems to bring to a close the work undertaken at Madison by Professor Holden. The greater part of the volume is taken up with the work of the Repsold meridian circle for 1884 and 1885, — the observation of the 303 stars which are to serve as reference-points for the southern zones of the *Astronomische gesellschaft*. A casual glance shows a satisfactory performance of the instrument; but we regret with Professor Holden, that under the circumstances, it has been possible to give merely the "results of observation, instead of accompanying them with the thorough discussion they seem to deserve." We note particularly the creditable part taken in both observations and reductions by Miss Alice Lamb, who appears in the *personnel* as one of the 'assistant astronomers.' A valuable piece of astronomical bibliography will be found in the seven pages devoted to a reference-list of the original sources from which errata have been taken in systematically correcting the star-catalogues contained in the observatory library. Some thirty pages are occupied with the results of meteorological observations; and a brief discussion is given of a longitude campaign undertaken, in co-operation with a government surveying party, to determine the western boundary of Dakota.

INDEX TO VOLUME VII.

**** Names of contributors are printed in small capitals.*

LIST OF ILLUSTRATIONS.

ERRATA.

Page 131, col. 2, 4th line from top, for 'times' read 'lines.'
" 131, " 2, 32d line from top, for 'sciences' read 'science.'
" 132, " 1, 1st line, for 'points to' read 'points.'
" 188, " 2, 27th line from bottom, for 'fifteen' read '1.5.'
" 250, " 2, 21st line from bottom, for 'two thousand' read 'two.'
" 395, " 2, 32d line from top, for 'Zygodium' read 'Lygodium.'

Page 492, col. 1, 2d line from bottom, for 'abilities' read 'utilities.'
" 535, " 2, 28th line from top, for 'them' read 'these.'
" 535, " 2, 12th line from bottom, for 'Zaphrentes' read 'Zaphrentis.'
" 536, " 1, 27th line from bottom, for 'probably' read 'possibly.'
" 536, " 1, 22d line from bottom, for 'Tahleh' read 'Zahleh.'
" 536, " 2, 14th line from top, for 'there' read 'these.